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THE NEW JERSEY STATE DENTAL SOCIETY

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SOUTHERN DENTAL SOCIETY

TRANSACTIONS

OF THE

ODONTOLOGICAL SOCIETY

OF

PENNSYLVANIA,

FROM ITS

ORGANIZATION,

FEBRUARY 1ST, 1879,

To the close of the year, 1883.

PHILADELPHIA.
SPANGLER & DAVIS, BOOK AND JOB PRINTERS,
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1884.

OFFICERS

1883.

President,

JAMES TRUMAN.

Vice President,

EDWIN T. DARBY.

Recording Secretary,

AMBLER TEES.

Corresponding Secretary,

H. C. REGISTER.

Treasurer,

E. H. NEALL.

Librarian,

W. G. A. BONWILL.

Executive Committee,

E. C. KIRK,
C. J. ESSIG,
LOUIS JACK.

Odontological Society of Pennsylvania.

A meeting of gentlemen favorable to the organization of a new Dental Society, was held at 1533 Locust street, on the evening of December 3d, 1878. Dr. F. M. Dixon was appointed Chairman, and Dr. Robert Huey, Secretary.

Dr. Louis Jack suggested the name "THE ODONTOLOGICAL SOCIETY OF PENNSYLVANIA," which was approved.

On motion of Dr. C. J. Essig, Drs. Essig, Jack, Tees and J. A. Woodward, were appointed a committee to draft a Constitution and By-Laws.

An adjourned meeting was held at 330 S. 15th street, on the evening of January 18th, 1879. The Constitution and By-Laws submitted by the Committee having been considered and revised, were adopted, together with a Code of Ethics. It was resolved that the first stated meeting be held at the time provided for in the Constitution, on the first Saturday evening of the ensuing month, and that the first order of business be the election of officers.

The first regular meeting of the Society was held Saturday evening, February 1st, 1879, at the office of Dr. C. J. Essig, 1533 Locust street. Dr. E. T. Darby was called to the chair.

The following is the list of members at date of organization :

CHARLES J. ESSIG,
MARSHALL H. WEBB,
H. C. REGISTER,
AMBLER TEES,
LOUIS JACK,
W. G. A. BONWILL,
E. H. NEALL,
H. C. LONGNECKER,
S. H. GUILFORD,
J. A. WOODWARD,
E. T. DARBY,
ROBERT HUEY,
DANIEL NEALL,
C. A. KINGSBURY,
F. M. DIXON.

The following officers were elected :

President, DANIEL NEALL.
Vice President, F. M. DIXON.
Recording Secretary, AMBLER TEES.
Corresponding Secretary, MARSHALL H. WEBB.
Treasurer, E. H. NEALL.
Librarian, W. G. A. BONWILL.
Executive Committee, C. J. ESSIG, E. T. DARBY, LOUIS JACK.

Essays and Discussions.

THE second regular meeting was held at the residence of Dr. Daniel Neall, 1627 Summer Street, on Saturday evening, March 1, 1879.

President, Dr. Daniel Neall, in the chair.

The following essay was read on

AMALGAMS.

BY CHAS. J. ESSIG, M.D., D.D.S.

Amalgam is the name given to any alloy of mercury and another metal. The amalgams form a very numerous class of compounds, and many of them are largely used in the arts.

Some of the amalgams are formed by direct contact of the metals, with evolution of heat; others are obtained by the action of mercury on a salt of the metal, or the action of the metal on a salt of mercury, assisted by the passage of a weak electric current in some cases.

Some amalgams are solid, others liquid. They are, generally speaking, weak compounds, many of them being decomposed by pressure, and all at high temperatures. Alloys for dental amalgams should possess the qualities of strength and sharpness of edge, and freedom from admixture with any metal capable of forming soluble salts of an injurious character in the mouth. It should also be capable of maintaining its color, although in an alloy composed of several different metals absolute freedom from discoloration, under the conditions to which an amalgam filling is exposed, cannot readily be obtained. It should also be capable of retaining its shape, as the tendency on the part of many amalgams to assume a globular form after their introduction, thus leaving the edges of the cavity unprotected, is probably a prolific cause of failure in this class of fillings. Undue expansion, although not so likely to occur as some other conditions, would be equally a source of failure. According to Mr. Fletcher, amalgams of silver and mercury alone expand sometimes sufficiently to split a tooth, and Mr. Kirby states "that amalgams of pure silver, either the precipitate or fillings, expand greatly;" with a suitable instrument for measuring he was able to determine the change in bulk of such an amal-

gam, in which he found the extent of expansion to reach one-fortieth of its diameter. Many old amalgam fillings have the appearance of projecting from the edges of the cavity, as though there existed some force behind or under sufficient to push them out. There seems to be some diversity of opinion respecting the cause of this, and, while it has been attributed to expansion, others have believed it to be due to the opposite condition. Favoring the latter theory, Mr. Fletcher states that he has found it only with those amalgams which are known to shrink, and he suggests that the plug may be raised, or forced out, by the "decomposition of tooth-substance and formation of gas under the loosened plug, the driving down and accumulation of food underneath, or some similar cause." It is evident that an amalgam possessing to a marked extent either property is not to be relied upon as a filling material, and both may cause the condition above referred to.

Discoloration of dental amalgams depends largely upon the formation of sulphides. The fluids of the mouth, in every case where the most scrupulous cleanliness is not observed, may be said to contain sulphur in combination with hydrogen, as dihydric-sulphide (H_2S), resulting from decomposition of particles of food lodging between and adhering to the teeth. The affinity of sulphur for both silver and mercury is so active, that we may reasonably assume that not only the discoloration of amalgam fillings, but in many cases their failure to prevent a recurrence of decay, is due to the action of that element upon the alloy. Neither is it safe, in compounding alloys for dental amalgams, to depend upon the protecting influence of metals which do not possess the same affinities, such as gold and platinum, for while these metals individually may remain wholly unaffected by contact with sulphur, it does not necessarily follow that their presence in an alloy will confer the same immunity upon such as silver and mercury. Indeed, the reverse of this may take place; and those which are totally insoluble in certain menstrua may be rendered soluble in them, by the addition of a metal on which they have the power of acting. In this way platinum, although of itself invulnerable to nitric acid, may be dissolved by it when sufficiently alloyed with silver. There are doubtless other causes for the discoloration of amalgams, some of them purely adventitious, depending upon the administration of certain remedies in disease, abnormal conditions of the fluids of the mouth or the presence of vegetable acids in articles of food.

An amalgam filling may retain its integrity of surface, while at the same time the darkening of the tooth-substance unmistakably indicates chemical action at its peripheral portion, due to imperfect adaptation favoring the ingress of the eroding agent. It appears that almost any amalgam filling may be kept bright by attrition, whether

of the brush or in mastication, and it seems equally certain that all amalgams will blacken, if the position which the filling occupies protects it entirely from friction. Again, an amalgam filling may retain its original color and brightness of surface, and yet not protect the tooth; and, conversely, a filling of this class may exhibit a great degree of surface discoloration, and yet fully preserve the tooth from further decay, peripheral discoloration being much the worse condition of the two.

In a number of experiments which I made with some of the well-known amalgams, such as Townsend's, Arrington's, "Standard Alloy," Lawrence's, Walker's, etc., as well as with some of the higher grade of my own compounding, consisting of gold, silver, tin, and platinum, I found that, with care in using the proper quantity of mercury and in packing the mass into clean glass tubes, which were then filled with colored fluid and closely sealed, apparently, after several weeks, not the slightest leakage occurred, and yet, when the same tubes were thrown into a solution of sulphureted hydrogen, the edges were attacked, and marked discoloration occurred, while the surface directly exposed to the action of the sulphur, and not in contact with the glass, was but slightly clouded. The edges had the appearance of having been eroded as by an acid. This experiment in not merely speculative, since it simply consists of filling a cavity with amalgam, and then exposing it to sulphur in the form usualy found in the mouth. The result is precisely similar to that which is observed in the great majority of amalgam fillings in actual service. It would seem, however, that the purely theoretical test of covering the plug with colored fluid, such as indigo, blue ink, etc., known as the "color test," is not to be relied upon in testing peripheral adaptations, for all the plugs used in this experiment had, apparently, excluded the passage of the coloring fluid. Yet, that they did not perfectly seal the tubes, although introduced under very favorable conditions, was abundantly shown by the result, which plainly indicated that solution of one or more of the constituents of the alloy had taken place, resulting in the formation of new compounds, consisting of sulphides of silver and mercury, and in some instances probably of copper.

Properties conferred by the different metals usually present as constituents of amalgams.—Tin dissolves very easily in mercury, but it hardens slowly and imperfectly. Without admixture with other metals it is unfit for use in the mouth. It is also well known to possess a tendency to draw away from the edges of any cavity into which it may be packed, and to assume a globular form. It never becomes sufficiently hard to answer the requirements of a filling material. Mixed with other metals, tin serves as a vehicle by which amalgamation is

facilitated and different degrees of plasticity obtained. For example, between mercury and silver these phenomena are more slowly manifested; by the addition of tin, however, both properties are easily attained.

Silver, apparently, unites very readily with mercury, yet it will be found, upon close examination, that complete solution of pure silver filings does not take place until after some weeks of contact, unless the silver, in a finely-divided state, be added to heated mercury, when amalgamation will be more readily accomplished. Amalgams of silver and mercury alone are said to expand. Silver, with tin added, yields an alloy very white in appearance, but more easily oxidized than either of the constituents; mixed with mercury an exceedingly unctuous and plastic amalgam is obtained, but it is somewhat slow in hardening, and there is much diversity of opinion in regard to the contraction and expansion of this alloy.

Dr. Hitchcock and Mr. Tomes both claim contraction* for it, while Mr. Kirby states that an "amalgam consisting of an alloy of three parts of silver and two of tin contracts slightly at first, but finally expands about $\frac{1}{500}$."† These variable results may depend upon the quantity of mercury employed; and I am satisfied that when an alloy of silver and tin is used, no excess of mercury should be present, and when this precaution has been carefully observed it has been found that the result is quite as good as those obtained with alloys of a higher grade. Thus, five hundred milligrammes of Arrington's amalgam, composed of silver, forty per cent.; tin, sixty per cent.,‡ mixed with one hundred and sixty milligrammes of mercury, withstood the sulphureted hydrogen test quite as well as those containing gold and platinum. It should be borne in mind that alloys composed of tin and silver only, require much less mercury to render them plastic than those containing additional proportions of gold and platinum.

Probably the most unfavorable condition observed in alloys of silver and tin is slowness in hardening, thus favoring the ingress of fluids by capillary force. The direct influence which silver exerts upon an amalgam of tin and mercury, when added to it, is to lessen the tendency to assume the spheroidal form, and to facilitate setting. In this respect its action is similar to that of gold; but while the latter further lessens these injurious tendencies and confers analogous properties, it cannot be made to supersede silver. In my first experiment with these curious compounds, I formed an alloy consisting of

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* Transactions New York Odontological Society, 1874.

† Ibid.

‡ Hitchcock, Ibid.

Gold,	500	milligrammes;
Platinum,	500	"
Silver,	2000	"
Tin,	2500	"

An amalgam of this alloy hardened almost instantly, so that a filling of it might be inserted and finished at one sitting. For the sake of experiment I made another ingot, omitting the silver; the result was an exceedingly brittle alloy, which could only be made to unite with mercury by heating, and even then with difficulty, and, after many days, it had not hardened sufficiently for use as a filling material. Thus it will be seen that silver fills an important place in dental alloys, since without its presence amalgamation becomes difficult and the valuable property of rapidity in hardening is lost.

Gold combines with mercury at all temperatures, but for rapid amalgamation an elevation of temperature is required, and the process is further accelerated by a state of fine division. With mercury alone it does not harden well; added to tin, it to a certain extent facilitates setting, but does not harden sufficiently for use in the mouth. Gold prevents the tendency to draw away from the edges; but when added to an alloy of tin and silver the greatest benefit is derived from its presence. I found that an alloy consisting of

Gold,	500	milligrammes;
Silver,	2000	"
Tin,	2500	"

when mixed with mercury in the proportions of five hundred milligrammes of the alloy of two hundred and fifty milligrammes of mercury, retained its sharpness of edge, hardened well in a few minutes, and apparently filled all the requirements of a dental amalgam. I am aware that it has been stated that gold added to an alloy of tin and silver retards hardening, but I suspect this to be an errror and the presence of an *excess* of mercury the real cause.

Platinum, in the form of plate or wire, does not unite with mercury. A very smooth and plastic amalgam may, however, be formed by rubbing some finely-divided platinum, such as is obtained by precipitation, with mercury, in a heated mortar.

An amalgam composed of platinum and mercury alone does not harden well. The properties of an alloy of tin and silver are also greatly impaired by the addition of platinum. I found an alloy consisting of tin two thousand five hundred milligrammes, platinum five hundred milligrammes, to be exceedingly brittle, and with its affinity for mercury lessened to such an extent that amalgamation was only accomplished by elevation of temperature and much rubbing, while the property of setting was almost entirely lost.

Added to an alloy of gold and tin, the same negative results are observed (see *Silver*); when combined with tin, silver, and gold, however, the real value of platinum becomes apparent; with the proper amount of mercury it seems to confer upon such an alloy the property of almost instantly setting, as well as greater hardness. Thus it will be seen that the qualities claimed for platinum *per se* belongs in reality to the combination of tin, silver, gold, platinum, and mercury, since if any one of the others is omitted the platinum not only remains passive, but actually, by its presence, causes marked deterioration of the qualities essential in a dental amalgam.

Alloys containing platinum amalgamate less readily then those wherefrom it is absent; yet when union has once begun, they seem to require a greater amount of mercury to render them plastic. By careful experiment I found that with an alloy of

Platinum,	500	milligrammes;
Gold,	500	"
Silver,	2000	"
Tin,	2500	"

the smallest amount of mercury which could be employed, without impairing the strength and general working qualities of the amalgam, was three hundred milligrammes of mercury to five hundred milligrammes of the alloy; while with another ingot, composed of

Gold,	500	milligrammes;
Silver,	2000	"
Tin,	2500	"

one hundred and sixty milligrammes of mercury to five hundred of the alloy afforded a perfectly good result.

The proper quantity of mercury should be ascertained by careful experiment. The statements of manufacturers or venders are not always reliable, if we may judge from the directions accompanying one particular compound, modestly called "The Standard Alloy," in which the proportion of mercury to the alloy is given at five to six,—an amount so greatly in excess that I found, in filling a tube with a mass composed of six hundred milligrammes of the alloy with five hundred milligrammes of mercury, that more than a third of the latter was expressed with very slight force.

In order to ascertain the amount of mercury required by different alloys, a small quantity of the latter should be taken, say one gramme, and after weighing, the mercury may be carefully added, and mixed by rubbing until the mass assumes a semi cohesive state; it should then be weighed again, to determine accurately the amount of mercury present: and may then be introduced into a glass tube and condensed by means of instruments slightly warmed. Should the proportions

not be correct, another trial may be made, and the quantity of mercury increased, or diminished, according to the result of the first experiment.

The quantity of mercury required by different alloys is probably definite, so that a tolerably accurate approximation of the composition of an alloy may be arrived at by carefully noting the required proportions of one to the other.

Different means are employed in the attainment of this object; probably the most common is to mix the alloy with a large excess of mercury, and then to express the surplus either by compression with the fingers, or through the pores of a piece of chamois-leather; the first involves a loss of some of the alloy, which is carried away with the surplus of mercury, and neither of them is to be relied upon as a means of excluding an excess of mercury.

There are also several methods employed in mixing amalgams. Probably the most common one consists in simply rubbing the two together in the palm of the hand; this is certainly the most expeditious, though not a very neat way, and much has been said about manifestations of the physiological effect of mercury following a long continuance of the practice. I have been to considerable trouble to ascertain the correctness of this theory, and while I have met some who have attributed certain phases of ill health to absorption of mercury applied in this way, yet I have been unable to directly trace a single case of ptyalism or any other well-marked sign of mercurial poisoning to this cause. It would be well to remember, however, that the active properties of mercury are developed by a state of fine division, and there is nothing unreasonable in the belief that mercury highly comminuted by rubbing in the palm of the hand may find its way into the system aud produce constitutional disturbance. In view of these facts it would be a proper precaution to prevent contact of the mercury with the skin; this may be accomplished by covering the hand with a piece of rubber dam, forming a sort of mitten, leaving the fingers free, and having an opening for the thumb to pass through.

Small porcelain mortars are also employed in amalgamation, but they do not speedily effect the desired purpose, in consequence of the granules of the alloy becoming burnished by the attrition of the pestle; heating the mortar will, however, greatly facilitate union.

Mr. Fletcher has recently called attention to a simple and effective method of mixing amalgams. The required weights of filings and mercury are put into a long, narrow test tube, or bottle, and well shaken for a few seconds; the percussive force brought to bear upon the mass quickly promotes union.

Some difficulty may be encountered in introducing amalgam fillings where the mercury has been reduced to the minimun; the semi-coherent mass, almost in the form of a powder, is not easily introduced into the cavity, especially if it be in the superior arch, and the only way by which it can be conveyed to the cavity is by first compressing some of the powder with a warm instrument, after which it may be handled with the pliers.

Fletcher has recently devised a sort of cylinder mould by which amalgams, mixed so dry as to be unmanageable, may rapidly be shaped into a convenient workable form; it consists of a cylinder into which the semi-coherent mass is poured, and by means of a piston the powder is compressed into disks of the desired thickness, which may be introduced into the cavity and solidly compressed with slightly-warmed instruments. It is claimed that this arrangement practically does away with the chief objection to the use of very dry amalgams.

Alloys.—Most of the metals are capable of uniting with each other, forming a class of compounds termed alloys, in which may be observed, to a greater or less extent, the properties of the several constituents entering into the union.

From a purely scientific point of view the study of the alloys is an interesting one, as they are not only mixtures of metals possessing certain distinct qualities, but may also be regarded as true chemical compounds, as in the appearance which often accompanies the union of the metals and in the properties of the resulting alloys we may frequently observe the phenomena which characterize affinity, such as heat and incandescence, resulting in the formation of substances having a definite composition, distinct crystalline form, and properties differing from those of their constituents.

The tendency on the part of metals to unite in definite proportions may be studied in connection with platinum, iridium, gold, rhodium, ruthenium and silver, when fused with tin. If the latter metal is in excess after cooling, a metallic ingot is obtained resembling closely the original substance; but by the action of strong hydrochloric acid the excess of tin may be dissolved, leaving crystals of a definite alloy of the tin and the noble metal, which cannot be further dissolved by the same acid, but are soluble in the hydrochloric acid even when the precious metal contained, whether rhodium, ruthenium or iridium, is, in the free state, absolutely insoluble.

It must not, however, be assumed that all the alloys employed in the useful arts are the result of one definite combination, many being capable of co-existing in the same alloy; this accounts for the difference frequently observed in the behavior of different parts of the

same ingot, and may be demonstrated in an alloy of tin, lead and bismuth, which melts below the boiling-point of water, heated to 20° C., and then permitted to cool; it will be observed by the assistance of the thermometer that the fall of temperature is twice distinctly arrested, and the cause of this phenomenon has been assumed as due to the production in the compound of a less fusible alloy, which in solidifying, evolves heat, and thus for a time retards the gradual cooling of the mass. It may therefore be assumed that true chemical combination may occur between two metals, notwithstanding the fact that such union may be masked by excess of one of the constituents.

Matthiensen, in an elaborate paper on the subject, states that "An alloy may be, 1st, a solidified solution of one metal in another; 2d, a chemical combination; 3d, a mechanical mixture; 4th, a solidified solution or mechanical mixture of two or all of the above."

Forming alloys for amalgams.—The putting together of the constituents of an alloy composed of tin, silver, gold and platinum, is a matter of no great difficulty, as it does not require an extraordinary degree of heat, and it may easily be accomplished in a stove or furnace such as is usually employed for heating or cooking purposes; the small reverberatory furnace recently devised by Mr. Fletcher and manufactured by the B. D. M. Co., answers very well. I have used one successfully in a large number of melting operations; and they cost but a small sum. The only difficulties likely to be met with in forming an alloy of this description are oxidation of the tin and the formation of certain definite compounds having a tendency to separate from the mass, thus affording an ingot which is not homogeneous.

Oxidation of the tin may take place at the instant of union with the platinum when a great elevation of temperature occurs; for this reason the platinum should not be in a too finely-divided state, as a condition of minute division greatly accelerates combination, and consequently increases the intensity of the accompanying phenomena of heat, etc. A quantity of borax should be fused in the crucible before the metals are melted, the object being to prevent adhesion of the alloy to the sides, to facilitate pouring, and to dissolve and hold in solution any oxide which may be present. Lastly, a layer of broken charcoal should be placed over the mass before heating; this will perfectly protect it from oxidation.

The formation of definite alloys, it has been shown, takes place with the gradual cooling of the mass, the fusing point and density of these being greater than that which remains fluid. They manifest a tend-

ency to settle to the bottom of the crucible in a solid state, and in some cases do not leave the crucible in pouring; thus the ingot may not possess the desired composition. Again, they may assume a semi-solid form, floating in masses in the more fluid portion, and setting at the moment of pouring at the bottom or sides of the mould, the result yielding an ingot which is not uniform in composition. In consequence of this it has been recommended that different parts of every ingot should be tested; but this difficulty may be entirely avoided by carrying the heat to a point of complete fusion, and pouring while still very hot, before the tendency to separate begins.

Oxidation of the surface from contact with the atmosphere will retard amalgamation. It is therefore better not to reduce the entire ingot to a state of fine division. It will be found to unite more readily with the mercury if freshly filed off as required for use; this can easily be effected with one of the coarse files sold at the depots as vulcanite files. Other metals, such as palladium, copper, cadmium, bismuth, antimony, and even zinc, have been used as constituents of amalgams. The four latter are of but little value, and some of them are liable to be converted into salts of a deleterious nature. Palladium confers similar properties to those obtained by the addition of platinum; but it is a rare and expensive metal, and is probably in no respect superior, as an ingredient in dental alloys, to platinum.

Copper is said to control shrinkage while it increases the tendency to discoloration. Most dentists would hesitate about employing an amalgam known to contain copper; yet I was much surprised recently at the result of a careful analysis of an amalgam filling which had done good service for twenty-three years, during which period it had retained a perfectly bright and smooth surface exteriorly. Having become loose by the fracture of a portion of the tooth, involving one retaining wall, in consequence of the gradual softening of the dentine the patient brought it to me, and I found its composition (after freeing from mercury) to be tin, 55 parts; silver, 40 parts; copper, 5 parts.

Brittleness may be increased or diminished according to the quantity of platinum present, and the resulting amalgam will exhibit this quality equally with the alloy. An amalgam filling should always be strong enough to retain its integrity of edge under the force of mastication. The formula from which I have obtained very good results is as follows:

Silver,	40	grammes;
Tin,	60	"
Gold,	3	"
Platinum,	3	"

Larger percentages of gold and platinum afford no better results, but, on the contrary, the alloy is rendered more brittle thereby; its affinity for mercury is lessened, while its capacity for the latter is increased, as shown under the head of Platinum.

Discussion.

Dr. Darby.—Dr. Essig has failed in his essay to refer to the proper method of alloying the metals, and much depends upon this. The silver should be melted first, and when at a boiling heat the platinum should be added in very small particles,—either rolled into thin ribbons or cut into minute pieces. Next, the gold should be added, and lastly the tin. When the mass is thoroughly melted, it should be well stirred, and immediately poured into the ingot mould. If this method is not followed there is danger of the platinum falling to the bottom of the crucible, and it will be found that the alloy is minus the platinum.

Dr. Essig.—Dr. Darby refers to the putting together of the metals. Between tin and the metals of the platinum group strong affinity exists, and when melted together tin and platinum combine with such avidity that incandescence accompanies the union, and it is only necessary to expose the two under favorable condition to a temperature of 600° F. The platinum does not settle to the bottom of the crucible in consequence of its greater specific gravity; that appearance is probably due to the formation of alloys of definite proportions as the mass cools. The way to avoid this trouble is to pour the alloy while still very hot, and before these formations take place. There will be no oxidation of the alloy if kept covered with fine charcoal during melting. I am using an alloy composed of tin, 3 oz.; silver, 2½ oz.; platinum, 2½ dwts.; gold, 2½ dwts. (Dr. Essig presented several specimens of exceedingly hard amalgams in glass tubes, the hardest of which, he said, was composed of silver, gold, platinum, and tin.)

Dr. Tees.—For the past eleven years I have experimented a great deal with these alloys for amalgam, and I have found that good results can be obtained with silver and tin alone. Dr. Flagg told the proprietors of one of the dental depots that Townsend's amalgam, composed of five parts of tin to four parts of silver, was as good as any. A quick-setting amalgam may be made from an alloy of four parts of silver to three parts of tin; but it makes a filling of a darker color than one made from an alloy in which tin is in excess. For many years I used an alloy composed of five parts of silver to three parts of tin. About seven years ago I filled for one of my patients several very large cavities with amalgam of this alloy; the fillings are still

in good condition and of a fair color. For the past three or four years I have been using an alloy composed of 40 dwts. of tin (chemically pure); 24 dwts. of silver (chemically pure); 1 dwt. of platinum filings.

I place the silver and the platinum filings together in a crucible, with a small lump of borax, and melt in a hot coke fire. Like Dr. Darby, I allow them to boil for fifteen or twenty minutes. I then melt the tin in another crucible and pour the boiling silver and platinum into it, and immediately pour the mass into an ingot mould.

It has been recently asserted that the platinum in the alloy does not unite chemically with the other metals, but having a mechanical union only, is lost with the oxide in the process of amalgamation. As a proof that this is not so, we find that an amalgam filling, formed from an alloy in which platinum is a constituent, is of a different character from one of the same proportion of the other metals, but containing no platinum.

In regard to ptyalism or other constitutional disturbances being produced by mixing the amalgam in the palm of the hand, I must say that I have been mixing it in this way for many years, and almost daily for the past ten years, and still I am enjoying excellent health.

Dr. Kingsbury.—In 1838, when I first used amalgam, it was prepared by filing the ordinary silver coin and amalgamating it with crude mercury. The result was a somewhat granular but very hard amalgam, that soon became dark-colored from oxidation. The proportion of copper in the silver coin doubtless increased its tendency to oxidize. After a time a portion of tin foil was added to the amalgam, which was regarded as an improvement, although the coin and the tin were not melted together as now to form an alloy previous to filing and amalgamating with the mercury. The first fillings of this kind that I ever saw were in the mouth of a clergyman, and in the approximal surfaces of the inferior incisors, which were badly decayed. The fillings were quite dark-colored and unsightly; yet the patient appeared much pleased with them.

For two or three years I used amalgam in filling badly decayed teeth, and with great satisfaction to my patients. Some prominent dentists took strong grounds against the use of it, alleging that it produced ptyalism in some cases. Some fatal cases were reported (notably one that occurred in Springfield, Mass.) as resulting from its use, and a strong prejudice was created against it. My judgment was overruled by the older practitioners and I abandoned it altogether, and did not use it again until the amalgam war was ended, and a revolution or change of sentiment took place in favor of its use in

special cases. I have used it to a limited extent in my practice ever since. I believe it to be valuable as a filling material when used with proper care and discrimination.

Since my residence in this city I have used a variety of amalgams,—more of Townsend's and Arrington's probably than any other. In conversation with Dr. Flagg recently on the relative merits of the different amalgams in use, he remarked that from his experience and the special attention he had given the subject he was led to believe that the old amalgam made from silver coin, with its small proportion of copper, so far as its chemical constituents are concerned, was just about what was needed.

Dr. Atkinson, of New York.—I do not know that I can add anything to what has already been said, except to suggest that the alloy, while in a state of fusion, should be poured into a tank of water, and afterwards, if necessary, remelted and poured into an ingot mould. I would not criticise the rest of the paper without being sure that I thoroughly understood it. Those who opposed the use of amalgam without reason, accepted it at last after the persistent efforts of those who strove after the truth; but these are not the ones who should lead the world. Experimentation is what is necessary.

Dr. D. Neall.—May I ask Dr. Atkinson what the theory of the action of amalgam upon the teeth is?

Dr. Atkinson.—Teeth are rendered calcified by it, so that after a filling falls out the tooth is saved by the deposits of lime-salts from the fibrin in the tubules. I have never seen this excessive hardening under gold.

The regular meeting of the society was held at the office of Dr. E. T. Darby, on Saturday evening, April 5th, 1879.

Awaiting the arrival of the essayist, the value, adaptation, and durability of the various oxychlorides, as filling materials, were discussed. Dr. Dixon expressed himself as much interested in experiments with these materials, and stated his belief that operative dentistry is on the eve of a great change, in the direction of the employment of earthy plastic materials; while he employed them with advantage, he finds they often prove of variable durability.

Other members expressed somewhat similar views, and deplored that thus far, all such agents lacked, in general, the important quality of durability. The subject being passed, a paper was read entitled

"CONTOUR FILLINGS, OR FLUSH—WHICH AND WHEN?"

BY S. H. GUILFORD, D.D.S., A.M.

The change in the methods of operative dentistry, within the past twenty years, has been most marked and radical.

More especially is this true in regard to that most practical portion of it, the filling of teeth. Many causes have combined to bring about this result, but none have exerted a more potent influence than the introduction of cohesive foil, and the invention of the rubber-dam and the various mallets. Before their discovery, all foil was non-cohesive in its character, or nearly so, and fillings introduced with it were usually only flush with the edges of the cavity. Now, fillings are introduced that not only fill the cavity but extend beyond it and restore in shape all that portion of the tooth which has been lost. The former method, practiced through many long years, and thus having been tried by experience and found efficient, has had and still has many advocates and followers; the latter, while it has not had the trial of so many years to test it, seems to have been tried long enough to have proven its efficacy and usefulness; and its advocates claim for it not only all the value of the old method, but, in addition, many points of superiority.

These two methods, while they are alike in their main object, the arrest of decay and salvation of the tooth, are diametrically opposite in all other respects. Each one has its supporters, and in the conflict so long waged and still waging between them, it would seem as though each one of us must choose his side.

Which one shall we adopt? Or, can we occupy a middle ground and use each and either, according to the circumstances of each particular case? In order to determine this matter intelligently, let us carefully but briefly review the claims made for each of them, together with their apparent advantages and disadvantages. The principal claims made for the *flush* method are: that it saves the teeth fully as well if not better than the *contour;* that it is more quickly done, and hence will be a saving of time to the dentist, and a saving of time and discomfort to the patient; that it is less expensive: and that as more teeth can be filled by it in a given time, the dentist can save more teeth in the course of his practice, and consequently do more good.

In regard to the first claim, of its saving teeth fully as well as the *contour* method, we must admit, those of us who have had much experience and have been observant, that the evidences of its efficacy are by no means few or far between. The monuments of its usefulness are constantly brought before our eyes in the form of fillings that have stood for fifty years and less, preventing decay, sustaining all the wear

and tear incident to their constant use, and looking as solid and good as they did the day they were introduced. Were it without merit, certainly these fillings, introduced decades of years ago, would not be daily confronting us as they are, speaking in silent eloquence the praises of their performers and the methods they used.

In simple justice, however, it must also be stated that of all the many fillings of this class, introduced years ago, that have come under our observation, none of them, so far as we can remember, were upon surfaces closely approximating one another. They were mostly upon the crown or buccal surfaces, or upon a surface made equally accessible by the loss of an adjoining tooth. Where they were upon approximal surfaces with no tooth absent, the teeth had been cut and filed to such an extent that there was scarcely a possibility of food remaining between them, and hence their liability to failure through recurring decay almost entirely prevented. Whether these approximal fillings, had they come in contact with each other, would have endured as long, is a debatable question; for our own part, we consider it extremely doubtful. If there were any of this kind, they had probably long ago succumbed to the ravages of time.

That flush or soft foil fillings, skilfully introduced (and unless skilfully done, no fillings will avail,) upon surfaces exposed to the attrition of food or the friction of the brush will last at least as long as any other kind, we have not the slightest doubt. Evidences, too numerous, have convinced us of this fact. Another item, in this connection, tending to detract somewhat from the glory of the soft-foil filling, is that most of those introduced years ago and remaining to-day, were placed in tooth-structure more dense and consequently more decay-resisting than much of that which we have to deal with to-day. The other claims are: the saving of time and lessening of discomfort in whatever form; the less expensiveness of the operations, and the greater number of them that can be performed in a given time; claims which we think must be granted by all. As to the saving of more teeth, that will depend entirely upon their durability in closely approximating surfaces, which will be discussed later on.

Flush fillings are sometimes made with semi-cohesive foil; but generally, they are made with non-cohesive foil, used on the wedging principle, which consists in continually forcing the gold first introduced toward the periphery of the cavity by means of wedge-shaped instruments, and then in turn adding new pieces of foil into the space or spaces thus produced. The foil, either in the form of cylinders or pellets, being soft, readily yields to this lateral pressure and moves in the direction of the force applied. In this way a very close adaptation of the gold to the margins can be had and a very dense

filling produced. More than this, the instrument never comes in direct contact with the margins of the cavity, and thus the carefully prepared edges are in no danger of being chipped or broken. When it is remembered that nearly all the failures in fillings arise from imperfect adaptation of the gold to the margins, or to the accidental injury of those margins by the plugger in filling, it will be seen that soft foil possesses very decided advantages. Still another advantage, and the last that we shall mention here, is, that it enables fillings to be introduced in almost inacessible places, by means of curved instruments and the use of the mirror, that could not be introduced with cohesive foil, without a large sacrifice of good tooth material to make the cavity accessible to the direct blow of the mallet.

The disadvantages urged against this method are, that not only cannot a portion of a tooth broken away be restored to its original shape by filling, and thus its masticating surface be increased, but teeth with cavities in them of a compound nature, have to be cut away so as to reduce them to simple ones, to enable them to be filled on the wedge principle. Another objection urged, is, that teeth filed apart to be filled, will in the course of time most likely be crowded together again, and then from the greater amount of surface in contact, decay will recur all the more quickly. Still another objection is, that whether the spaces artificially produced, close together again or not, the food lodging in them creates discomfort in eating and makes it difficult of removal. And lastly, is urged the unsightliness of the filed teeth and the adjacent spaces.

Now let us see what claims are made in favor of *contour* work. One is, more perfect preservation of the teeth—first, by having no dentine exposed; second, by their touching at one point only and that point of gold, instead of tooth structure; and third, by the prevention of the packing and lodgment of food between them. Another claim is, that by the restoration of the original shape of the teeth, the masticating surface is greatly increased. Another is, greater comfort; in that by their touching at the masticating surfaces, the violent packing of food between them is prevented. And lastly, greater harmony and beauty is claimed, by the avoidance of unsightly spaces.

In regard to the first claim, of the more perfect preservation of the teeth, we believe that, (other things being equal) teeth are far less liable to decay where only gold and enamel are exposed than where the more frail dentine is also exposed. Gold cannot decay, and we all know that after decay has once penetrated through the enamel, the destruction of the dentine is much more rapid. We also firmly believe that where teeth touch only at a single point, their liability to destruction is very much less than where they touch at many points or

over a large surface. While teeth, fully restored in shape, and touching, do certainly prevent the violent packing of food between them, still, food will to some extent find lodgment in the space above, where they do not touch, and if not carefully removed, will often cause a recurrence of decay. With regard to the other claims, that the masticating surface is increased or kept up to the maximum amount, and that teeth thus filled tend to greater comfort in mastication, and that, with their shape restored, even with the inharmonious color that the gold presents, they are more beautiful in appearance, will, we think, be granted by all.

The objections to this method are: first, the length of time required for these operations, and the consequent exhaustion to both patient and operator, and suffering by the patient; second, their expensiveness, partly from the amount of gold used, but more particularly from the amount of valuable time requisite to their proper performance; and in the third place, most patients will not appreciate our skill and labor after it has been expended. The first objection, the exhaustion of the patient and operator, is certainly a most true and valid one, and should be seriously considered. The second, of expensiveness, will stand or fall according to the financial ability of the patient; while the third, that of appreciation, will be true in many instances, but not in all.

Thus, hastily sketched, are the more prominent advantages and disadvantages of each method. If we decide to adopt either of them for our practice, we should consider carefully the *pros* and *cons* of each, and then be governed by the decisions of our respective judgments. But, need we adopt either, to the exclusion of the other, as so many are doing, or would it be better to measurably adopt both and practice either, according to the apparent requirements of each particular case? The objection to methods, as such, consists in the fact that while a method usually contains many features that are useful and practical and worthy of adoption, no method contains all that is good in that particular branch. Each one contains a certain peoportion of good and bad features, and it is only in the preponderance of the good over the bad that any can lay claim to superiority. If we adopt any one exclusively, we have to accept its objectionable features with its good ones; whereas, if we bind ourselves to no theory in particular, but select from the various methods their good features and use them with judgment and discretion, we will probably accomplish a greater amount of good. This eclecticism in practice, is, I think, what we all need and should adopt.

But, it may be asked, "How shall we know when to practice the one, and when the other?" Let us see. In all simple cavities on any

of the three more exposed surfaces of the teeth, all fillings are in the very nature of the case contour fillings. On the lingual and crown surfaces, they will necessarily be concave, in order to conform to the curved surfaces of the teeth; while on the buccal and palatine surfaces, they will necessarily be convex. This will be so whether they be made of either soft or cohesive foil. No effort will be needed to give them these forms; they will naturally assume them. The same may be said of simple fillings on the approximal surfaces, where the adjoining tooth or teeth have been removed. If, however, they should happen to be only flush where the outline of the tooth is convex, it will do no harm, for the preservation of the tooth will be just as complete. This being true, the only debatable question remaining, of a vital character, is in regard to the best method to be pursued in the filling of cavities on the approximal surfaces of adjoining teeth.

In the matter of the six front teeth, if the cavities in them be confined strictly to the approximal surfaces, they may be separated and filled contourly with cohesive foil, or they may be filled only flush with soft foil, and in either case be very well preserved with ordinary care on the part of the patient. If, however, the decay in any case should involve or necessitate the removal of the cutting edge at the corner, we must be governed in our decision of the manner of filling by the taste and finances of the patient. If the patient prefers the sight of gold to the appearance of a space, and is able and willing to pay for the work, the tooth should be filled with cohesive gold and the broken portion fully restored. Should the patient object to the sight of gold, or not be able or willing to pay for the elaborate work of the restoration, then the surface should be dressed to a straight line and the simple cavity filled with either soft or cohesive foil, whichever the operator thinks he can do the best work with.

In deciding the same question in regard to the bicuspids and molars, besides the considerations just mentioned with reference to the front teeth, two additional items will have to be taken into account. One is, the age of the patient; and the other, the number of teeth in the arch and their proximity to one another. Should the patient be under twenty, and the teeth in consequence be not as dense and able to resist the decay-producing influences always present in the mouth, as they would be later in life, and if in addition the teeth should all be present, in line and touching one another, then we think they ought to be filled contourly and their perfect shape preserved, especially if the approximal decay has gone so far as to include a portion of the masticating surface. For, if these teeth should be separated by filing or cutting, the lateral pressure of the other teeth, aided by the soft and yielding character of the alveolus, and sure to be greatly increased

by the subsequent eruption and pressure of the wisdom teeth, will certainly cause the closing of these spaces, and decay will be the result, sooner or later. If, however, the teeth be not all present, or scarcely or not at all touching, nor likely to become so by the coming wisdom teeth, then the teeth may be permanently separated and filled flush, with a prospect of their lasting as long as contour.

If the teeth to be filled have been previously filed apart and filled, and have not closed together, then they may be filled again in the same way. The likelihood of a recurrence of decay on filed surfaces, and indeed anywhere, is greatly lessened after the patient has arrived at the age of thirty-five or thereabouts, when the dental tissues have reached their maximum compactness and strength.

As a summing up of this whole matter, we would say, in regard to approximal cavities in the biscuspids and molars, if the teeth are in close contact, or in the future likely to become so, fill them *contourly* and thus preserve their separation at the necks. If, however, the teeth do not touch, nor are likely to, they may be permanently separated and filled *flush*, with equal hope of durability. Such is my practice, and I have been led to it through years of experience and observation.

Discussion.

Dr. E. T. Darby, while expressing his gratification with the whole tenor of the paper, yet did not agree with the statement that the usual positions of successful non-cohesive fillings were the buccal and coronal surfaces. On the contrary, in his experience, he had frequently found fillings of ten, twenty, or more years standing, on the approximal faces of teeth which were in close contact, and would, for illustration, refer to the approximal fillings of the late Dr. Elisha Townsend, so many of which were perfect to this day, after having been in the service from twenty to thirty years. He further declared his confidence in the value of non-cohesive foil, in many approximal cavities, believing the adaptation to the walls to be better than when cohesive foil is used. He recommended the employment of common sense, with an appreciation of the requirements of cases, before deciding upon the quality and grade of the gold to be used. He also advocated the use of cohesive gold, when the cases required building out, and thought the practitioner should use that which, from the nature of the case, promises the best result.

Dr. Daniel Neall was fearful that too many dentists have a greater disposition to practice what may be called decorative dentistry, than they have to seek for the means which will best preserve the teeth, and in this connection, felt that the strain often imposed upon the patient, was out of all proportion to the good accomplished, and then defended the use of soft gold.

Dr. Essig advocated and supported by statements and arguments, the advantages of filling approximal cases by the contour method, and also maintained that, ordinarily, but little more time was required to operate in this manner than by the flat plan. His procedure, he stated, is to press the teeth well apart, and fill in to such a form that, when finished, a space remains near the gum, the gold being in contact near the coronal surface. His views were decided that, without a greater degree of cleanliness than is ordinarily attainable, a recurrence of decay may be expected at the cervical portion of the teeth, which are permitted to come in contact at near that point.

Dr. Webb stated that he was glad to have heard Dr. Guilford's essay; he was gratified to find that the essayist, as well as many others who had, but a few years ago, advocated permanent separations, had now evidently made decided advancement in their modes of operating. He referred to the second article of the "Accepted Creed," (so called), as given with the tenth article of the "New Departure Creed," in which the statement is made that "Some have faith in coutour; others, faith in separations." With him, it was more than a matter of faith. "He knew that contour method was the best," and his confidence in contour work was strengthened every suceeding year. He thought the essayist had not made the proper distinction between simply saving the teeth, or what remains of them, and fully restoring them to usefulness. He stated that his understanding of contour work is the restoration or building out of the gold to the line that bounded, defined, or terminated the original figure, and may be concave, in part, as well as convex, as in the case of crowns of bicuspids and molars. He did not doubt that if a cylinder of so-called soft foil, and one of cohesive foil be used, the non-cohesive one could doubtless be readily adapted by pressure to the cavity; but he believed the proper way to use foil was to fold and cut it into narrow strips, and then commence from a definite starting point, and build out with a properly-adjusted electro-magnetic mallet, shaping the tooth as the filling progressed.

Dr. Dixon declared his appreciation and confidence in good contour work, but deprecated its attempt by any but those who thoroughly understood how it should be done, and who have the ability to put their knowledge into practice. He had met with so many attempts in this direction, which were so lamentably unsuccessful—they being simply large masses of gold, without the proper form—that he would advise all to practice upon plans which will enable them to preserve the largest number of teeth for the longest time, and recommended such practitioners to keep to these simple methods until they

felt sure they had acquired the ability to thoroughly do contour operations.

Dr. Bonwill defended the employment of the various new mechanical appliances, maintaining that they were an advantage to both patient and operator, and believed the public also regards these inventions as among the greatest blessings of the age. While deploring the necessity for their use, he further stated that the difficulties of making good operations have increased, and that we are brought to face the fact that but few operators have the ability, with the unaided hand, to preserve the teeth by their operations. Machinery has had to be placed at their command to enable them the nearer to approach the degree of perfection that only a few have attained.

The regular meeting of the society was held Saturday evening, June 7th, 1879, at the office of Dr. Daniel Neall, 1627 Summer Street.

The following paper was read upon

"THE ACCEPTED CREED."—PROPER PRACTICE.

BY MARSHALL H. WEBB, D.D.S.

When the "creed of the New Departure" was announced at the meeting of the New York Odontological Society, November 20, 1877, the following so-called accepted one was also presented as the "time-honored and ordinarily 'accepted creed' ":

"Accepted Creed" (so-called).

Article I. "Gold is the best thing to save teeth."

Article II. "Some have faith in contour, others faith in separation."

Article III. "Failure in operations is mainly due to defective manipulation."

Article IV. "A tooth that is worth filling at all is worth filling with gold."

Article V. "Unskilled and unscrupulous dentists fill with tin covered with gold, thereby causing galvanic action, pulpitis, death of the pulp, abscess, and loss of the tooth."

Article VI. "A filling to be good, must not leak."

Article VII. "Gutta-percha, properly used, is good enough for temporary fillings."

ARTICLE VIII. "A good gutta-percha filling in its proper place is better than a poor gold one."

ARTICLE IX. "Amalgam, *per se*, is a poor filling material."

ARTICLE X. "The use of plastic filling materials tends to lower the standard of dentistry, thereby diminishing its sphere of usefulness."

Many parts of this creed are not approved by first-class practitioners, nor is it "ordinarily accepted."

The best operators are guided by the principles stated in the following ten articles, and these indicate the proper or accepted practice. Since these notes refer not only to the "Accepted Creed," but to that of the "New Departure" also, it may be well to give each article of this creed with that of the proper practice:

ARTICLE I. New Departure.—"In proportion as teeth need saving gold is the worst material to use."

ARTICLE I. Proper practice.—Gold properly and skilfully used is the best material known for restoring the teeth to usefulness, and for their permanent preservation.

ARTICLE II. New Departure—"We do not believe that either" (contour or separation) "has much to do with the final result."

ARVICLE II. Proper Practice.—Restoration of the contour of missing tissue, when the whole operation has been carefully and thoroughly performed, and the gold finely finished, is the best, nearest perfect, and highest style of operation for the preservation of the teeth.

ARTICLE. III. New Departure.—"Failure in operations is mainly due to incompatibility of filling material with tooth bone."

ARTICLE III. Proper Practice.—"Failure in operations is mainly due to defective manipulation." If gold be perfectly impacted against dentine and enamel, and its surface smoothly finished, fluids and semi-solids cannot enter between the material and tissue against which it is placed—and without moisture no chemical action can take place—and there cannot, therefore, be the least "incompatibility" between the gold and dentine and enamel.

ARTICLE. IV. New Departure.—A tooth that can be so treated as to be satisfactorily filled with anything is worth filling.

ARTICLE IV. Proper Practice.—With the aid of the rubber dam a tooth, or a part of a tooth, that can be operated upon at all can be filled and saved with gold, provided the operator has the ability, and if he has not, then he ought to use that material with which he can best succeed.

ARTICLE V. New Departure.—Skilful and scrupulous dentists fill with tin covered with gold, thereby preventing decay and pulpitis and thereby saving the tooth.

ARTICLE V. Proper Practice.—Skilful operators or first-class practitioners perform operations with gold (and for a time and occasionally with other materials) so as to prevent disintegration, irritation or death of the pulp, abscess, and loss of the tooth or teeth operated upon. When the tissues are diseased operators of this class aid nature to get the parts in normal condition, and then fill and save the organ.

ARTICLE VI. New Departure. "A filling may be the best that is known for the tooth, and yet leak badly."

ARTICLE VI. Proper Practice.—A filling to be first-class "must not leak." Where the operator cannot insert gold perfectly so as to make the filling moisture-tight and the operation permanent, he should use in the incisor and cuspid teeth a cement or gutta-percha; and in the bicuspids and molars tin foil, that oxidation of the metal may take place at parts where fluids are not excluded, the oxide formed assisting "to arrest decay."

ARTICLE VII. New Departure,—"Gutta-percha, properly used, is the most permanent filling material we possess."

ARTICLE VII. Proper Practice.—"Gutta-percha, properly used," is a very good material for temporary fillings, and where there is no friction from mastication, or from the free use of the tooth-brush and floss-silk, it may prevent decay for several years, or as long as it remains in place.

ARTICLE VIII. New Departure.—"A poor gutta-percha filling, in its proper place, is better than a good gold one."

ARTICLE VIII. Proper Practice.—"A good gutta-percha filling, in its proper place, is better than" a very imperfectly inserted one of gold or any other material.

ARTICLE IX. New Departure.—"Amalgam, *per se*, is an excellent filling material."

ARTICLE IX. Proper Practice.—Amalgam, *per se*, is not a good filling material, yet, if an operator cannot so insert any other as to save the tooth, it were better to use this than to extract the organ. Amalgams leak, oxidation takes place, and this, to an extent, checks or retards decay negatively; the surrounding tissue becomes discolored (especially the dentine in the teeth of young persons), causing an unsightly disfiguration; to which is to be added, the breaking away from time to time of portions of enamel from the margins left unprotected by the shrinkage or contraction of the alloy.

ARTICLE X. New Departure.—"The use of plastic filling materials tends to lower that dentistry which has for its standard of excellence ability to make gold fillings, but very much extends the sphere of usefulness of that dentistry which has for its standard of excellence, ability to save teeth."

ARTICLE X. Proper Practice.—The use of plastic materials does not tend to that careful preparation and the development of that manipulative ability which is absolutely necessary for one to possess before he can truly be a fine operator or first-class practitioner throughout. The "standard of excellence to make gold fillings" is to properly perform and finish operations so that if an operator can do this he can save all the teeth of his patients with gold—in connection in some cases with oxychloride of zinc to prevent shock from thermal currents. If a practitioner of the first class deems it well to use an alloy or any other material, he can do so more successfully than one who has not ability to perform operations perfectly with gold.

DISCUSSION.

DR. DARBY.—I do not profess to be an authority upon this or any other subject, but I do feel that it is one of great interest to every practitioner of dentistry. The teachings of the so-called "New Departure" have had and will continue to have great effect upon many in the profession. The tendency of such teachings is to make slovenly, careless operators. If I tell a student or practitioner of dentistry that amalgam, gutta-percha, or other plastic materials are as good or even better than gold, the danger is that he will use them instead of gold in many cases where gold should be used. It is not all men who are capable of judging when a tooth should be filled with gold or with some plastic filling. The teachings of Flagg and others are dangerous, and to promulgate them cannot but be attended with great harm to the beginners in dentistry—especially harmful if taught in our dental colleges. I have recently had some correspondence with Dr. Barrett, of Buffalo, New York, whose paper, in answer to the creed of the so-called "New Departure," is, in my judgment, the best which has appeared. Dr. Barrett meets the subject fully and squarely, and it seems to me his arguments are convincing. He tells me that the tendency with country practitioners is to use more amalgam and slight that part of dentistry which requires the greatest amount of skill in its performance. My observation has been that amalgam and gold may be used in the same tooth, and in immediate contact, with no unfavorable results, notwithstanding the theories which have obtained to the contrary. I saw but a few days since a tooth which had been largely filled upon one approximal surface with gold, and upon the masticating and other approximal surface with amalgam—the two fillings meeting—without the slightest injury being done to either tooth or fillings. Experiments in the laboratory and experiments in the mouth do not always bring about the same results.

DR. ESSIG.—I should like to know the experience of the members respecting the consequences of filling two approximal cavities respectively with gold and amalgam, contact of the two being permitted.

DR. DARBY.—I should not have allowed them to touch.

DR. ESSIG.—The statement is often made that where the same cavity is made to contain both gold and amalgam in contact no electro-chemical action takes place; and if I am not mistaken, it has been claimed that such combination preserves the tooth better than gold alone. I do not understand how this can be the fact, and am inclined to think that gradual solution of the amalgam, assisted by a weak electrical current, does go on in all such cases; and I am strengthened in this belief from the fact that wherever I have seen amalgam joined to gold, the surface of the former had the appearance of having been acted upon by an acid, and was not bright even when on the masticating surfaces of the teeth, as is the case generally with amalgam fillings when not in contact with another metal.

DR. JACK.—Recently I filled two teeth, one with gold, and the other with amalgam. The latter tooth was highly sensitive, and it was impossible to fill it immediately with gold. The fillings were not in direct contact, but near each other. I find there is disintegration in the walls of the teeth, and abrasion and discoloration of the amalgam, and, to some extent, disintegration of the enamel tissue at the inner portion of the cervical wall. I have always avoided the association of tin and gold. I understand that Dr. Flagg claims that the relation of the two is the salvation of the tooth. What we want is a careful, minute examination into electro-chemistry. No one is engaged in it but men who have a personal pecuniary interest in it, except, perhaps, Dr. Palmer, who, as far as I know, has no pecuniary interest in it. All men who are falling away from manipulative ability will lean on plastic materials, but it is an unphilosophical way of dealing with the subject. The question is, What material is the best to preserve the tooth? As far as the old creed is concerned, Dr. Flagg has expressed it well. That is not the accepted creed of a few individuals, but of a large proportion of the profession. As far as my sentiments go, gold, *per se*, is the best material, and the only disquilification is the difficulty of performing good operations with it.

DR. DIXON.—I would ask Dr. Jack if he means to say that gold is the only thing that has been found to save teeth permanently.

DR. JACK.—If we had a material that was free of all objections I would at once discard gold, and we would all be fools if we continued to use gold.

DR. D. NEALL.—Dr. Woodward has been complaining of the non-uniformity of the gold.

Dr. Darby.—Gold-beaters complain about the atmosphere affecting the working properties of the gold. There are certain conditions of the atmosphere when it is almost impossssble to produce good working foil.

Dr. Essig.—Gold-beaters experience trouble from the action of the atmosphere upon the molecular arrangement of the gold. This is probably what Dr. Woodward complains of.

Dr. D. Neall.—My father put a tin filling in one of my teeth. One day I put a five-cent piece in my mouth, and it gave me a shock. This first gave me an insight into galvanic action. I think the question of our possibly starting galvanic action in the mouth need give us no anxiety. If we start it, we can also stop it. So in regard to electro-chemical effects. In a long practice I have seen nothing in that direction to deter me from the use of amalgam in connection with gold. For fifteen years I have been in the habit of patching large compound gold fillings with margins of amalgam, especially at the cervical borders and where it was out of sight and the cavity difficult of access, and I find they are as closely united as if made of but one material. Many years ago I inserted a small plate for a gentleman. Recently, having lost other teeth, I put a clasp around his lateral incisor. It held nicely, but that lateral had a large, shallow cavity in it, which I thought I would fill with amalgam instead of gold. He came back to me and said that he had a galvanic battery in his mouth. I put a piece of silk string around the tooth, when the galvanic action ceased. Six weeks ago I placed an amalgam filling in a large superior molar. A few months before I had filled it with gutta-percha, which had worn out. The lady was wearing a plate with a clasp around this tooth. She came back complaining of a shock. I wove silk around the clasp, but she still complained of the pain. I then cut off the clasp, and have not heard from her since. I recently saw a large amalgam filling which extended up beyond the margin of the gum, which I placed in the cavity some time ago. There was a gold filling in the middle of the amalgam, at the cervical margin.

Dr. Darby.—Was the amalgam filling of which you speak unduly oxidized?

Dr. D. Neall.—It was of a dark color, as we generally find Townsend's amalgam.

Dr. Bonwill.—I believe I have not heretofore publicly expressed my opinion upon the principles of the "New Departure." My experience in practical dentistry and in electrical experiments will not allow me to adopt this new theory. To give my reasons therefor would require an essay. To totally deny gold a place in filling materials is almost too bold. Much as I have cursed the results of gold fillings, I am not

blind to the fact that they are from bad manipulation and the use of it when other materials would have been better. I think if the advocates of this theory would resort to the means now at our command to enable capable men to insert gold fillings, they would find no necessity for a "New Departure." I have never yet seen a tooth decay that was filled well with gold; but if the smallest leak be left decay will occur. The advocates of this theory lose sight of one important factor in the play of caries. If the best amalgam filling of contour surface be brought in contact with tooth-substance on the approximal wall of the contiguous tooth, and this contour surface of metal be as close as in nature, without any room for cleansing, these approximal surfaces will form a capillary tube to suck up the starchy elements in the saliva. If on the buccal and palatal walls of the cavity the enamel be not cut boldly away, to so separate those walls that no food may be held by capillary force, then the filling will fail, and would fail if it were gold. It is not galvanic, but chemical action from starch, induced by capillary action, which causes decay in tooth-substance wherever it is permitted to contiuue, whether before or after filling. *First*, I advocate anticipation; *second*, when this cannot be done in time before caries has begun, contouring must be resorted to in all teeth posterior to the cuspidati.

Dr. Darby.—Have you stopped making permanent separations between the teeth?

Dr. Bonwill.—No, sir, I have not abandoned anticipation. If gentlemen will honestly try the plan I advocate, and not judge of it without either having tried it or seen its results, then there will be some excuse for the opposition to it.

Dr. Dixon.—I have seen but little that could be called galvanic action, or its effects, arising from the presence of two or more metals in the same mouth. Although I believe from the statements of others that it does take place, yet I have come to look upon mischief from that cause as almost mythical, having never noticed injurious effects of any kind that could be traced to it. I have seldom if ever added amalgam to gold fillings, but I have often patched amalgan with gold, obtaining excellent results. I will cite a case in point. The posterior approximal surface of an inferior bicuspid had decayed all over, but being too sensitive to admit of cutting retaining-points in it, I filled it with amalgam. From time to time as the tooth decayed I patched it with gold, until the whole filling, except cervically, was and is circumscribed with gold, since which no decay has taken place. I have treated teeth in other mouths in the same manner with the best results. I have repeatedly refilled teeth with gold where amalgam has signally failed.

Dr. Essig.—Dr. Dixon once showed me a mouth in which frail teeth were all filled with gold, and told me that in that mouth amalgam was poisonous. Will Dr. Dixon tell me what he meant by that?

Dr. Dixon.—It was an inadvertent expression. I have met with a number of cases where amalgam seemed to act as a solvent,—dissolving, as it were, the tooth-structure at the periphery of the filling, and to some extent wherever it came in contact with it.

Dr. Jack.—May I ask Dr. Dixon if in that mouth the gold fillings preserved the teeth when the amalgam did not?

Dr. Dixon.—Yes, sir! the gold fillings preserved them admirably. Here let me remark in regard to the teachings of the "New Departure," that they are doing incalculable mischief. A great many well-meaning practitioners, some of them very capable men, are swayed by them and led astray. Most, if not all of us, have been in the habit all along of using the materials recommended in the "New Departure" and approving of them to a limited extent, especially where good gold fillings are impracticable. We should not be too ultra in either direction, but eclectic, and certainly progressive.

Dr. Webb.—I do not know that Dr. S. B. Palmer lays any special stress upon the so-called incompatibility of gold with dentine, but he has several times stated that for chemical action to take place and currents to be started about any metallic filling there must be leakage. He states that where there is no leakage there is no action. Dr. Palmer's opinions and theories should receive proper consideration because he is an earnest and conscientious investigator, and I do not think is interested in the manufacture or sale of an alloy or other material. Those thus interested cannot well give an unbiased opinion, neither should they assume to be teachers who cannot so perform operations as to make fillings moisture-tight. The rubber dam can be applied, though with difficulty in some cases, and gold can be so inserted and finished at the cervical wall and other parts as to prevent fluids from entering between it and the dentine and enamel against which it is placed. Dr. Palmer has suggested that tin be placed at the cervical wall, where there is difficulty in so placing gold as to make the part moisture-tight, because tin becomes oxidized, and this oxide of tin closes the breach, is an antiseptic, and assists in arresting decay. Where an operator cannot insert gold so perfectly as to make the filling moisture-tight it will probably be best for him to use tin foil, that it may become oxidized at those parts where the filling does not exclude fluids, and that the oxide may be present "to arrest decay." One who has not the ability to properly perform any operation with gold may resort to plastic fillings. In reference to the case stated by Dr. Dixon, I would say that he evidently did the work so

thoroughly that no leakage could occur between the gold and the tissue against which it was placed; whereas after a time—perhaps a year or two—shrinkage of the amalgam took place, and leakage ensued sufficient to admit the agents that brought about disintegration; hence the failure of the amalgam fillings of which the doctor speaks. I have seen like cases, and these prove the "incompatibility" of amalgam with "dentos." Dr. Dixon states that he inserted gold as well as amalgam fillings in the case he mentioned, and this indicates that the teeth were such as to be readily acted upon by destructive agents—calcification had not taken place in the polyhedral fields of the enamel-rods and throughout the dentine.

Dr. Bonwill.—In regard to uniting amalgam with gold in a tooth or in contiguous teeth, I was disposed for a long time not to so use it, fearing trouble from galvanic action; but results observed led me to try it where a good gold filling was found defective at the cervical wall. Nor do I hesitate to use it in a tooth whether dead or alive, adjoining one filled with gold. In doing so where gold touches amalgam in proximate teeth, the teeth must be pressed apart for some distance and then the filling made contour, so that when they come together again no ordinary attrition will cause them to separate. If they touch loosely, then galvanic shock must occur. While the poles of a battery are in contact, no sensation nor shock can be felt from the most intense current; but if disconnected and again touched, then comes the sensation. My object in this patchwork is the salvation of the tooth,—utility rather than elegance. If I had a large cavity to fill in a molar or bicuspid tooth, with the decay extending beyond the gum, and I found it difficult to keep that portion of the cavity dry, I should fill that part with amalgam and the rest of the cavity with gold.

Dr. D. Neall.—I was driven to do this thing on what might be termed a moral basis. Dentists are sometimes charged with pulling each other's work to pieces. This seemed to me unprofessional, and, in some cases dishonest. Rather than pull my professional brother's work or my own to pieces in the attempt to remedy a small defect, I have, time and again, patched these fillings with amalgam, and they have returned to me in good condition. We have long outlived the nonsence of '38 and '40 with regard to the noxious qualities of amalgam, and we may, for strong reasons now well based upon experience, apply it fearlessly in all proper cases, knowing and holding it to be a most useful and reliable agent.

Dr. Essig.—May I ask Dr. Bonwill the condition of the surface of the amalgam when it is in contact in the same cavity with gold?

Dr. Bonwill.—If exposed to attrition, it will not discolor; if not disturbed, it will discolor.

Dr. E. H. Neall.—As something has been said of the "ideal filling,"—one that shall combine all the advantages of gold and have none of its defects, I would like to ask the gentlemen if they have had any experience with Weston's Insoluble Cement. I have experimented considerably with it during the past four weeks, and find the results so far to be good. The material requires great care in mixing; rapid manipulation and absolute cleanliness being indispensable, as the cement should be in position in the cavity of the tooth while it is quite plastic. The best results can be obtained by placing two or three drops of the fluid upon a piece of ground glass, and then rubbing in the powder with a small spatula. One great advantage it has over oxychloride fillings is its freedom from escharotic action. The material can be placed in a badly-decayed tooth, where the nerve is nearly exposed, without the least inconvenience to the patient. My experience with it is too recent to testify as to its durability, but I have seen incisors that have been built up on their cutting edge, and stood the wear and tear of severe usage for six months, and show no perceptible change.

Dr. Dixon.—I have been using the Weston Insoluble Cement for two months, and I am greatly pleased. I hope it will prove to be all that is claimed for it.

Dr. Guilford.—A year or two ago I filled a very frail central on the mesial surface with oxychloride. There was at that time a gold filling in the other approximal surface. Lately one-third of the crown was broken off parallel with the cutting edge, and both fillings came out. I thought this would be a good case in which to test the Weston Insoluble Cement, especially as the incisor teeth were very long, very thin, and very much curved. After considerable difficulty, I succeeded in getting the tooth filled and built out to its original shape. I burnished it with an agate burnisher in about five minutes after its insertion. I told the lady not to spare it in eating, but to give it a thorough test. Thus far—a month or two—it has done very well. The only fault she finds with it is its unnatural bluish tint. If it stands this test it will prove itself the strongest cement filling we have ever had.

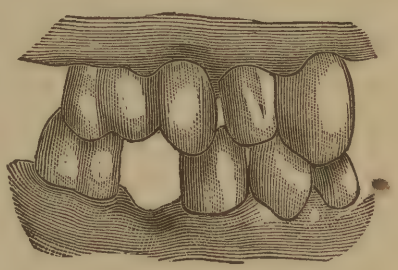
Dr. Tees.—Like Dr. Dixon, I am inclined to believe many of these cases of galvanic action to be entirely mythical. I have never yet met with a well-defined one in my practice. In many instances the sensation can be traced to pressure of the filling upon the pulp, or to trouble arising from a devitalized pulp. A patient of the late Dr. George J. Barclay, of Pittsburg, an expert contour-filler, called upon me three or four years ago, and requested me to fill a very large cavity on the mesial surface of an inferior molar with amalgam, saying that Dr. Barclay would not use the material, and that he did not wish to

submit to the prolonged and tedious operation of having a gold filling inserted. There was a large and beautiful contour filling on the distal surface of the adjoining molar. I filled the cavity with amalgam for him, and in a short time he returned, complaining of galvanic action between the two fillings. On his return to Pittsburg, Dr. Barclay removed the amalgam filling, and inserted a gold one in its place. On his return to Philadelphia, the gentleman called to see me again for other services, and on inquiring whether the removal of the amalgam filling, and the insertion of the gold one in its place, had relieved him of the sensation, he told me that it had not, that it still annoyed him.

The regular meeting was held Saturday evening, October 4th, 1879, as the office of Dr. W. G. A. Bonwill, 1719 Locust street, Dr. Dixon in the chair.

INCIDENTS OF PRACTICE.

Dr. J. A. Woodward.—One of the sequences of the extraction of the lower first permanent molars, after the eruption of the second molars, is that the space left is only partially closed. The lower second bicuspid articulates usually with half of the grinding surfaces of the upper bicuspids, and may become, especially when its cusps are decidedly developed, after the loss of the lower first molar, practically a wedge, exerting sufficient force in mastication to gradually seperate the upper bicuspids, should they for any cause have space to move apart. The lower second molar articulates with the upper first and second molars, and generally, in the absence of the first lower molar, as already mentioned, leans or tilts forward, depressing the mesial grinding surface so that the distal half only articulates. The lower third molar usually comes in contact with the second molar, and holds it in its abnormal position. Thus, from the changed relation of the articulating surfaces of these teeth, force is so expended that the upper second bicuspid and first molar are continually forced together. If the mistake is made of treating their approximal surfaces on the permanent separation plan by cutting through to the triangular space at the necks of the teeth, separation of the upper biscuspid is permitted. Should the blunder be made of separating again (isolating the teeth), then a still further



driving apart of the upper bicuspid follows—the gradual advancing of the second lower bicuspid into the space between them; and also the contact of the upper second bicuspid and first molar. By the time this condition is established the patient has probably reached thirty-five, and the side of the mouth where the teeth have been treated in this manner is very often almost useless in mastication. To restore a degree of comfort and service, it may be necessary to cut away the lower second bicupid so that the upper bicuspids can be made to approach; to wedge the second bicuspid and first molar as far apart as can be prudently done, and then to restore the contour of their approximal surfaces. If the space between the upper bicuspids can be obliterated and contact re-established between all the upper teeth, more perfect use of the teeth in mastication would be attained, but it is not often that this can be accomplished—the discomfort being generally endured by the patient until it is too late. If, upon examination the approximal surfaces of the upper second bicuspid and first molar are found free from caries, in the absence of the lower first molar as above stated, and there is a reasonable probability that they will escape disintegration, due allowance being made for the want of attrition, it would be best not to interfere; but should there be indications that they will not escape, then it would be best to separate in anticipation, cutting, equally from each tooth, a free space, leaving a firm shoulder at or near the gum to retain permanently the space. Should caries have progressed so far as to make filling necessary, then the contour of the teeth should be retained—the purpose in both plans of treatment being to prevent any loss of space whatever at the necks of the teeth.

Dr. Darby.—As a rule, I am opposed to the extraction of the sixth-year molars, unless they be removed before the eruption of the twelfth-year molars. In some mouths, where it is thought best to remove the sixth-years molars to prevent undue crowding, it should be done, in my judgment, at about eleven and a half or twelve years of age. I saw, but a few days since, the ill-effects of having waited too long before removing the tooth in question. The second molar had tipped forward, making a bad articulation.

Dr. Dixon.—I have seen the mischief in repeated instances.

Dr. Essig.—I submit a hastily made sketch of a crowded state of the teeth, by which the right inferior second bicuspid is prevented from assuming its proper position. The patient is sixteen years of age; the first molar is comparatively free from caries; the teeth in both upper and lower arches are irregular.

I have thought it best to remove the first bicuspid, but would be glad to have the views of the members present.

Dr. J. A. Woodward.—If the second bicuspid could be extracted, I would prefer to remove it. If it could not be extracted, then I would extract the first bicuspid, allowing the second bicuspid to take its place. Recently, under conditions nearly similar, the second bicuspid was removed with good results.

Dr. Darby.—A dentist recently sent me a model of irregularity. The sixth-year molars had been removed, and the second bicuspids on either side had taken their places back against the second molars, leaving large spaces between them and the first bicuspids.

Dr. Essig.—I have recently been experimenting with the view of arriving at a quick and reliable means of making quantitative analyses of amalgams. I at first supposed that this might be accomplished by cupellation under the oxydizing flame of the blow-pipe. I started with a gramme of amalgam, the proportions of which were known; this was mixed with about four times its weight of pure lead. These were first melted in a small crucible, with borax, in order to thoroughly incorporate them. The resulting alloy was then placed upon the cupel, and the oxydizing process commenced. At the end of about thirty minutes all the lead had been converted into litharge, and had been absorbed into the porous substance of the cupel, carrying with it the tin, as well as any other oxidizable metal present in the amalgam. At this point the button, having parted with every trace of the tin, became exceedingly bright, and thus offered a means of ascertaining when the process of cupellation was complete. It would seem that this method of getting rid of the tin—the constituent that so greatly complicates the analysis—was all that could be desired; but the well-known property of melted silver of absorbing oxygen from the atmosphere at high temperatures, and then parting with it as it approaches the point of solidification, caused sputtering, by which minute globules of the metal were thrown off and lost, thus rendering the assay inaccurate, and forcing me to abandon the cupel. I next took a thousand milligrammes of an amalgam alloy, which I fused in a small crucible with borax, using one of Fletcher's blast furnaces. When the temperature had been carried to somewhere near the melting point of gold, crystals of potassium nitrate were dropped through the opening at the top into the crucible, and in fifteen minutes the button was allowed to cool. It was then weighed, and found to have lost 450 milligrammes, being exactly the proportion of tin in the alloy. This button consisted of silver, 450 milligrammes; gold, 50 milligrammes; platinum, 50 milligrammes. The separation of these however, is a matter of no great difficulty. The use of the cupel usually affords

reliable results, when the work is done in a properly-constructed furnace, wherein a uniform temperature is obtainable; but it is difficult to secure this uniformity with the blow-pipe flame; hence the loss by sputtering. The wet process of assaying amalgam alloys is one of uncertainty, until the tin has first been removed by deflagration with potassium nitrate, when the remaining button is rolled into a ribbon and acted upon by nitric acid. The gold will remain at the bottom of the vessel, in the form of a brown sediment; this should be washed and heated to redness, and is then ready for weighing. Platinum, when combined with a large amount of silver, is rendered soluble in nitric acid, so that, if any of that metal is present, it will be found in the silver solution; the latter should be precipitated by sodii chloridum, and after washing and drying, may be reduced by heating with the sodii carbonate, or else by subjecting it to the action of hydrogen, when it may be heated to redness, washed and weighed; the platinum may be secured from the remaining solution either by precipitation or by evaporating and heating the residue.

Dr. Guilford.—I have brought a few knick-knacks along with me, which may be new to some of you. The first is a cheap substitute for the Southworth wood-polishing points. It consists of the smallest size wooden mole, mounted on a plain screw mandrel. The moles cost but a few cents per hundred, are of hard wood, last long, and are very effective. The next is a simple way of preventing the rubber-dam from puckering when the wedge is passed between the teeth, and consists of holly strips, torn to the width of about a quarter of an inch, and cut to the shape of a flattened gold pen, with this point placed between the teeth, and against the dam, the wedge can be driven without trouble. The new celluloid strips are also good for this purpose, pointed in the same way, and laid with the corundum side against the rubber. I formerly used boxwood and quill, but the holly and celluloid are more convenient. I also wish to show you the way in which I easily and quickly form a band matrix. We often need them to simplify such an operation as filling a bicuspid when only the cusps remain. I take a piece of thin silver plate, an inch and a half in width, and as long as required, champering one edge, and flowing soft solder upon it. This I keep in my drawer, and when I want a matrix, I cut a strip as wide as I wish from it. Bending this quickly until it is the shape and a little longer than the circumference of the tooth, I hold it with a thin pair of pliers, aud solder in an instant over an annealing lamp. After a little filing it is ready to be placed over the tooth. I have just finished for a patient the operation of mechanically tightening the four superior incisor teeth that had become loose through excessive use, caused by the loss of most of the masticat-

ing teeth. The canines remained, and were firm. I took an impression of the lingual surfaces of these teeth, and made a die and counter die in the usual manner. I then took a piece of half-round gold wire, about an eighth of an inch in diameter, and long enough to extend along six palatine surfaces, with perhaps a quarter of an inch to spare at each end. This was bent to conform as nearly as possible to the inner surfaces of these teeth, resting upon their basilar ridges and partially encircling the canine teeth like clasps. After being bent with pliers as closely as could be, it was swaged exactly into place. Holes were then drilled through the wire—two to each of the incisors opposite their mesial and distal surfaces, each of the two holes connected by a shallow groove. When placed in position in the mouth, thin platinum binding wire was passed around each tooth separately, through the holes opposite, and drawn tight, and twisted by means of pliers. The ends were then turned over the bar and tucked in underneath it. The operation, the first of the kind I know of, was a complete success, and both patient and operator were much pleased. The gentleman had before had his teeth laced with platinum wire, but it would always slip up or down, and thus fail to hold them firmly. This latter appliance could not slip, and the teeth were held firmly in position.

Dr. Essig.—I use metallic retaining wire always with hesitation, since a short time ago I met with a case in which a platinum wire had apparently made quite deep grooves across the labial surfaces of the lateral teeth as though due to electrolysis.

Dr. Guilford.—I have no faith in the chemical theory.

Dr. Darby.—Whilst at Long Branch attending the New Jersey State meeting, my attention was directed to a new preparation of gutta percha for fillings. Dr. Oliver is the manufacturer and agent for the preparation. I have used it ever since, with great satisfaction. It is nearer the old Bevin's cement than anything I have tried. He also sells a boiler with which the preparation is softened. I have also been using the oxyphosphates as prepared by Drs. Weston, Pierce and others. In my judgment these preparations will supersede the oxychlorides. They are especially valuable where a quick-setting cement is desired, a few moments being sufficient to admit of packing gold upon them.

Dr. Guilford.—I fear somewhat the action of the phosphoric acid upon the dentine.

Dr. Essig.—Unless the resulting compound is of a neutral character the tooth substance would suffer.

Dr. J. A. Woodward.—The prosphate cements produce so decided an effect upon the pulps of teeth which are sensitive or painful to

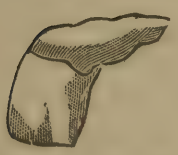
changes of temperature—all pain and discomfort ceasing promptly—that I have been led to question the wisdom of using them largely, until we know more of the final results of their insertion in teeth with living pulps.

Dr. Bonwill, at the request of the society, gave a history of some of his inventions and appliances. He exhibited his mechanical mallet for attaching to any foot-engine, which he claimed to be superior to the electric mallet, having all the virtues of the lead and steel hammer or wood mallet, with the rapid blows of the electric; he stated that he had not used the latter since the mechanical was perfected. He exhibited the mother dental engine, made in Delaware before he had ever seen such a device. In the field, he said he was not the first, although he placed the first foot engine by treadle in the market —Green's pneumatic being the only one then out. He showed three distinct epochs in its history, which finally resulted in the flexible arm which he is now using, and which he claims has all the power and delicacy that would seem necessary, making 5000 revolutions per minute. He also exhibited his surgical engine, intended solely for performing all operations on the bones, by amputation or resection, or removing necrosed bone, as well as denuding the mucous surfaces by the application of corundum wheels instead of steel. It has a speed of 15,000 revolutions per minute, and carries a saw of two to three inches diameter and burs of half-inch to an inch, without any liability to break the parts from such heavy strain. He showed a reciprocating saw making 30,000 movements per minute, cutting both ways as keenly as if done with a plane. It has been severely tested at the University of Pennsylvania, the Jefferson College and Pennsylvania Hospital, without a failure. This is another of the gifts of dentistry to medicine, which has been adopted by them without hesitation. It promises as much in surgery as the dental engine in dentistry. Dr. Bonwill exhibited another device for the engine which he thinks will supersede the use of fine dividing files for dressing up contour fillings. It is simply the fissure burr made pointed and very small. It can be inserted between the teeth, and fillings finished quickly and smoothly without danger to the gold. He also exhibited a bayonet-shaped tool, with three angles, for separating incisors on the palatine surfaces. It supersedes the diamond, is extremely hard, and cuts very rapidly and smoothly. It can be used for the bicuspids and molars, between the cervix and bucco-grinding surfaces, in anticipation of caries, and for opening into cavities from the buccal side of bicuspids and molars in either jaw. He also showed disks made of hard rubber and corundum, which he claims are superior to those made of shellac.

The regular meeting was held Saturday evening, November 1st, 1879, at the office of Dr. E. T. Darby, 1513 Walnut street, Dr. D. Neall in the chair.

INCIDENTS OF PRACTICE.

Dr. E. H. Neall.—I wish to exhibit a specimen of what I should call distortion of the left superior permanent central incisor, the root of which is at a direct right angle with the crown. Some years ago I heard a somewhat similar case described as dilaceration. But why dilaceration, I could not understand, as Webster defines the word to mean, "The act of tearing or rending asunder." The peculiar condition of the tooth before you was caused by a fall, which dislodged the temporary incisor, and at the same time distorted the permanent tooth, whilst in a semi-solid condition. Cases like the present one are exceedingly rare, and, as far as I recollect, our text-books are silent with regard to them. The history of the case is as follows: At about two years of age, the patient, a boy, fell, during play, and broke out the left superior incisor, at the same time loosening the adjoining central. At about seven years of age, the right central made its appearance, but very much within the arch of the inferior teeth, to correct which, a plate was made and the tooth brought into its proper position, but not without considerable effort. The left central did not make its appearance until the patient was nearly ten years of age, when a thickening of the alveolus was observed; this continued for several weeks, when the libial surface of the central could be distinctly traced under the gum. Lancing was advised and submitted to, and in a few days afterwards the entire labial surface of the tooth was exposed to view. Shortly after, the tooth was removed readily, whilst the patient was under the influence of nitrous oxide.



Dr. Darby.—An interesting case of necrosis came under my treatment early in the summer. The patient was a lad of fourteen years. The superior central and lateral teeth were quite loose and the alveolar process exposed, with the apex of one of the roots. Upon examination, I felt that both teeth must be sacrificed with the socket of each. The teeth were removed with very little force and a small pair of forceps; the outer and inner plates of the alveolus and septa were removed in one or two pieces. I used a strong solution of chloride of zinc upon the soft tissues, and sent the lad away. In a week's time he returned, when, to my surprise, all suppuration had ceased, and a permanent cure was effected. I have since seen the case, and there is no return of the disease. The cause of the disease was unknown to the parent of the boy, but, in my opinion, was the result of chronic ab-

scesses upon the central and lateral incisors, and their death the result of a blow.

Dr. Essig.—I am inclined to think it advisable to introduce an obturator, in cases of this kind, to prevent disfigurement by the remaining teeth changing their place. Three years ago I had a boy under my care who had lost ten teeth by being kicked in the face by a mule. An artificial denture was introduced, and I believe the mouth will be in a better condition ten years hence than if no such appliance had been employed. I have another patient, a middle-aged man, who had met with a similar accident in childhood; he had no artificial applance until he had reached maturity, and there is much disfigurement from change in position of some of the remaining teeth.

Dr. Darby.—I have in my practice a lad who has been so unfortunate as to lose both central incisors, the result of accidents. The first was knocked out by falling against a stone; a few months later he was hit in the mouth by a bat, and lost the other. His parents were opposed to filling the space by an artificial denture, preferring rather that Nature should fill the space. After two or three years Nature has more than half done the work. I have recently inserted a plate having one central, the centre of which would represent the medium line. The peculiarities of the case are—*first*, that the approach of the two laterals has been uniform, notwithstanding the interval of time which elapsed between the loss of the right and left central; and, *also*, that the cutting edges of the laterals did not converge, but stand in a line with the necks of the teeth. I have often noticed the ill effects of extracting a tooth on one side of the mouth and not the corresponding one on the other side; the medium line will be changed. I have noticed this in mouths where a six-year molar has been removed on one side and the one on the other allowed to remain.

Dr. D. Neall.—I am not disposed to operate in this way. I would keep the tooth for mastication, in spite of looks. I heard Townsend advocate that doctrine thirty years ago, but I could not agree with him.

Dr. Dixon.—I have had an interesting case, which illustrates a difficulty medical men sometimes experience in diagnosing diseases arising from devitalized pulps, and also the very simple remedies that will frequently cure abscesses that have for months baffled their skill. The case was that of an Irish girl about twenty years of age, of rather delicate health, sent to me with a troublesome and painful ulcer of the lower maxillary bone, having existed for more than a year, and having formed an opening under the chin, and on a line with the root of the lateral incisor. She had for six months been under treatment by two

surgeons of well-known skill, at one of our hospitals; two operations had been performed, and she was told that if there was no improvement by the next visit they would extract some of the teeth. At this crisis she was induced by her employer to call upon me for advice. Finding, upon careful examination, the pulps of the right inferior central and lateral both devitalized, caused, most likely, by a black flinty tartar, with which the roots were coated fully one-half their length. I bored into the pulp chambers, starting the drill at the sulci of their lingual surfaces; then thoroughly purified each canal, and probed through the apical foramen, producing a slight hemorrhage, and dressed with dilute carbolic acid, carefully removed the tartar, and sent the patient home. The dressing was repeated, on alternate days, three times. At the end of eight days the teeth and their roots were filled, and the patient dismissed cured. She continues well. Had this course been pursued at the time the trouble commenced, it is quite certain that her year's pain and anxiety would have been avoided. A similar case is mentioned in Garretson's work, but the teeth were extracted.

Dr. Bonwill.—There was in my office to-day a child eight years of age, whose temporary central incisors had been out for three months; the permanent centrals were coming forward, but, directly back of the left central, the left lateral was erupting with equal speed. I have deferred action until I am convinced that it will be prudent to extract the left temporary lateral.

Dr. D. Neall.—I would immediately remove the temporary lateral, and place a ligature around the permanent.

Dr. Tees.—A few days since a gentleman called my attention to the peculiar condition of his superior maxillary bone, on the left side. There was a well-marked depression, extending from the canine to the wisdom tooth, and fully one-half an inch above the necks of the teeth, in depth about a quarter of an inch. None of the teeth were gone, and he said that he had never met with an accident, nor had any disease in that region.

1880.

The regular meeting was held on Saturday evening, January 3d, 1880, at the residence of Dr. Daniel Neall, 1627 Summer Street.

INCIDENTS OF PRACTICE.

Dr. Essig described the audiphone as made at present, and thought it could be improved upon by having a diaphragm attached and something for the teeth to grasp.

Dr. Jack related an anecdote of a deaf gentleman who heard the conversation of two friends by placing one end of a key against a column in the room, and the other end between his teeth. The labyrinth of the ear and its nerves were in a normal condition. He thought an audiphone made of thin metal would be more sensitive to impressions than one made of hard rubber. He referred to the importance of the mouth in the conveyance of sound, since in listening to faint sounds it is kept open.

Dr. Dixon.—I would like to call attention to tin foil as a material for permanent fillings. I have used it of late much more than formerly, having had my attention drawn to it particularly by finding teeth filled with it in 1876 by the late Dr. De Morat. First-class gold fillings in the same mouths, made at the same time by the same hand, had needed repeated repairs, without which the teeth would have been lost. Tin foil, as now prepared, is very soft and plastic, and easily made into excellent fillings. I conscientiously bring the matter before the society, believing that very frail teeth can be better saved by tin than by gold fillings in many cases, probably owing to its lower conductive power. Besides, I do not remember having ever met with a devilitalized pulp under a tin filling where devitalization had not taken place prior to its insertion. I also think that fillings well made of the tin as now prepared last much longer on the grinding surfaces than they did years ago.

Dr. Jack.—I have found shredded tin unsatisfactory, as the particles do not become united, and are too small to exert any binding force upon each other.

Dr. Darby.—In approximal cavities which do not extend to the masticating surfaces, tin is as good, if not superior to gold, as a material for filling. It does not discolor tooth-structure like amalgam.

Dr. Jack.—The excellent preservative properties of tin are due principally, I believe, to its softness and pliability, which render it not difficult to adapt to the surface of the cavity without the employment of much force. This, it seems to my mind, accounts for its superiority over gold in very soft teeth. I have had opportunity to know that the force requisite to solidly pack and condense gold is fre-

quently injurious to the enamel borders of cavities. This is more particularly the case where ordinary mallets are employed in filling teeth, because, if the first gold against the cervical walls is packed to a proper degree of solidity, every subsequent blow of the mallet extends its force to the last layer. The repetition of blows may often be damaging to enamel borders of imperfectly calcified enamel, which would have no perceptible effect upon sound and flinty enamel. I have even observed injury inflicted upon the margin of cavities by hand-pressure when I have had reason to believe the instrument had not been in contact with the tooth. Tin has also the further advantage of being an indifferent conductor of heat.

Dr. D. Neall.—I used tin largely thirty-five years ago, but subsequently preferred gold, as then it was quite as adaptable as tin, and not so subject to waste as the latter upon the grinding surfaces. I have used it somewhat lately and hold it to be a metal less incongruous with tooth-substance than gold. I put in a tin filling in 1843. I had watched it for thirty years. At the end of this period it had worn away considerably, but the margins of the cavity did not decay. I put in a cap of gold foil upon it, and both fillings remain sound and secure to this day. I think we must admit that experience demonstrates that tin is kindlier in its union with tooth-substance than many of the gold foils of the present day.

Dr. E. H. Neall.—In certain cases, where the teeth show a low degree of calcification, as well as in the mouths of young children, I think tin foil an excellent filling material, as it can be easily and quickly packed and quite as readily trimmed down flush with the margin of the cavity; indeed, very often the plug can be consolidated and nicely finished with a strong burnisher, so that the corundum disk need not be used, thereby sparing the enamel borders from the least abrasion. Some eight years ago I used a great deal of tin in the mouths of children; many of these fillings I have seen from time to time, and, with the exception of being worn down by mastication, they are in excellent condition, thoroughly preserving the teeth, and also without the discoloration noticeable around amalgam fillings. The tin foil supplied the profession at present I think of superior quality.

The regular meeting was held on Saturday evening, Feb. 7th, 1880, at the residence of Dr. Daniel Neall, 1627 Summer Street.

The following remarks were made on

LIVING MATTER THROUGHOUT THE DENTAL AND OTHER TISSUES.

BY MARSHALL H. WEBB, D. D. S.

The illustrations* shown, and the remarks to be offered in relation to them this evening, refer mainly to some of the investigations and discoveries made during the past few years by Prof. Carl Heitzmann and Dr. C. F. W. Bodecker, of New York City.

The subject is interesting and instructive, as the more perfect our knowledge of the living matter throughout the tissues, the better qualified we are to make fine discriminations in reference to deviations from normal action, and the more fully prepared we become for the prevention, treatment, and cure of diseased tissue and the restoration of organs to their original type.

Max Schultze was the first to describe the delicate "thorns" which pierce the cement-substance between epithelial bodies and connect one such body with another (Fig. 1, *d*).

Fig. 2.

Fig. 1.

Part of papilla of the gum near a tooth, magnified 350 diameters; *a*, flat epithelia; *b*, cuboidal ephithelium; *c*, columnar epithelium; *d*, Max Schultze's thorns; *e*, connective-tissue corpuscles; *f*, small vein; *g*, reticulum of living matter; *h*, capillary; *i*, connective-tissue bundles.

* The drawings for the cuts to illustrate these remarks were made by Dr. Bodecker from the specimens he prepared.—M. H. W.

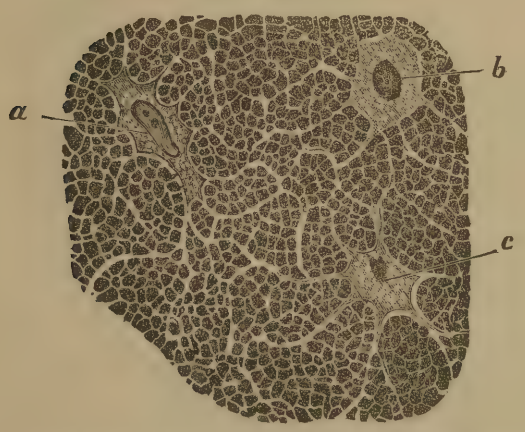
These lines which Max Schultze termed thorns, were described by him in 1864.

Carl Heitzmann discovered the minute structure of protoplasm and that of the various tissues of the animal body in 1873, and about the same time found that Max Schultze's thorns are fibers of living matter, and that they are continuous with the reticulum of living matter in the epithelial bodies themselves (*g*, Fig. 1); he also attributes the movement of the cilia of the ciliated epithelium to the constant action of this same living matter throughout the epithelial body. The cement-substance in all epithelial and endothelial formations is pierced by fibers of living matter.

Dr. Heitzmann describes the netlike structure of protoplasm thus: "The nucleolus is connected with the wall of the nucleus, and this again with the granules of the protoplasm by very fine threads, which are to be regarded as the living matter of the protoplasm, while the fluid contained within these meshes of living matter does not possess the property of life" (see Fig. 2, *a*, a protoplasmic body of the cementum, magnified 1200 diameters).

It is questioned whether the fluid within the meshes or reticulum of living matter is really lifeless. The main properties of living matter are motion (the swelling of the granules at the points of intersection of the reticulated structure), the capacity to produce its own kind (in inflammation and reproduction), and the violet staining it receives from a half per cent. solution of chloride of gold. Each atom of the basis-substance within the net-like arrangement of the fibers of protoplasm surely possesses what is termed affinity (and may have several degrees of affinity), and one atom under certain influences becomes connected with another to form a molecule, and so on, in the manner several times stated by Dr. Atkinson, till granules and bodies are formed. Is this not life?

Fig. 3.



Cross-section from compact bone of lower jaw of a man about thirty years of age, manifested 1000 diameters; *a*, *b*, and *c*, protoplasmic bodies or bone-corpuscles.

Soon after his discovery of the net-like structure of protoplasm, Dr. Heitzmann observed that the living matter, in the form of a reticulum was present in the three varieties of connective tissue, viz.: myxomatous, fibrous, and cartilaginous. In Fig. 3 are shown three protoplasmic bodies (*a*, *b*, *c*); from the

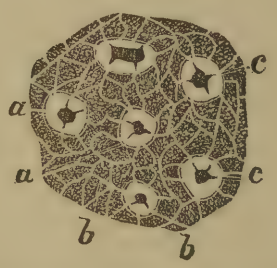
offshoots of these fibers of living matter are distributed through the light reticulum of the basis-substance of the bone.

Fig. 4.

Union of dentine with enamel. *D*, dentine; *E*, enamel; *a*, *a*, dentinal fibers, being in union large protoplasmic bodies *b*, *c*, *d*, or directly running into enamel-fibers *e*, *g*. The latter often are lost in the delicate irregular network on the bottom of the enamel *f*, *f*. Magnified 1200 diameters.

Dr. Bodecker extended Prof. Heitzmann's discoveries to bone and other tissues, cementum, dentine, and enamel and is now studying the pulp. He found in fresh specimens (magnified 1200 di-

Fig. 5.



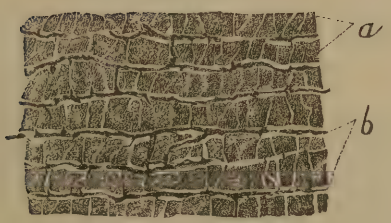
Cross-section of dentine of incisor Stained with ½ per cent. solution of chloride of gold. Main mass of dentine. Magnified 2000 diameters. *a*, *a*, dentinal canaliculi with the central dentinal fiber, *c*, *c*, the latter with star-like off-shoots; the basis-substance between the canaliculi pierced by a delicate light network, *b*, *b*.

ameters) that fibers of living matter from the "odontoblasts" along the periphery of the pulp during the formation of the tooth, and the protoplasmic bodies of the same when the organ is fully formed, not only enter the dentinal canaliculi, but extend beyond the boundary-line between the dentine and enamel (Fig. 4, *g*) as well as into the cementum (Fig. 9, *b*). In tracing the fibers of living matter through the dentinal canaliculi and across the line of union of the dentine and enamel, Dr. Bodecker found delicate fibers extending between the columns of the so-called enamel prisms (Fig. 4, *g*.) He also observed that the fibers do not quite fill the canaliculi, and that there are cone-like projections all along each fiber of living matter, the point of each of which is invariably directed toward the light reticulum throughout the basis-substance connecting one caliculus with another (Fig. 4). This he found to be the case not only throughout bone-tissue, cementum, and dentine, but also in the enamel. "In cross-sections of dentine the dentinal canaliculi are visible in the shape of round or oblong holes; the center of each is occupied by the dentinal fiber" (Fig. 5,

c, *c*). Every fiber sends innumerable delicate conical threads into the basis-substance between the canaliculi, and throughout this substance is present a minute network of living matter. Around each canaliculus the basis-substance is denser than between the canaliculi. The fibers of living matter between the enamel rods (Fig. 6, *b*) are very slender, and the network within the rods (*a*) is extremely minute. Enamel is said to be calcified epithelium, and this is indicated by the well-marked resemblance between the enamel prisms and cuboidal epithelial bodies (Figs. 7 and 1). The prisms (*b* and *c*, Fig. 7, magnified 2000 diameters) have nuclei and granules, as do the cuboidal epithelial bodies, and like them are polyhedral and connected by very delicate threads of living matter (*e*). The origin of enamel is as yet an unsettled matter.

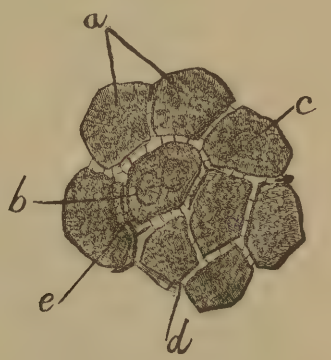
In some sections made from dry specimens there are visible what have been termed "interglobular spaces," but during the life of the tissue such a space contains protoplasm. "The dentinal fibers enter the protoplasm, and each fiber is united with the network of the latter by means of delicate thorn-like projections." The protoplasm sometimes contained in the spaces in specimens consists of "embryonal

FIG. 6.



Longitudinal section of enamel. *a*, enamel-rods, traversed by prevailing vertical spaces; *b*, enamel-fibers, branching and partly uniting through delicate offshoots; numerous fine thorns of the fibers directed towards the light interruptions within the rods. Magnified 1200 diameters.

FIG. 7.



Cross-section through enamel. *a*, rods of enamel partly exhibiting formations like nuclei; *b*, *c*, *d*, light interstices between the rods traversed by delicate beaded fibers, *e*, or by vertical thorns. Magnified 2000 diameters.

elements which have not been transformed into basis-substance and not calcified." If the system be kept up to the normal standard of health, and function be unimpaired, the fluid within the meshes of the network of living matter may be formed into glue-giving basis-substance, lime-salts be deposited, and tissue like that in which these spaces are found may be formed.

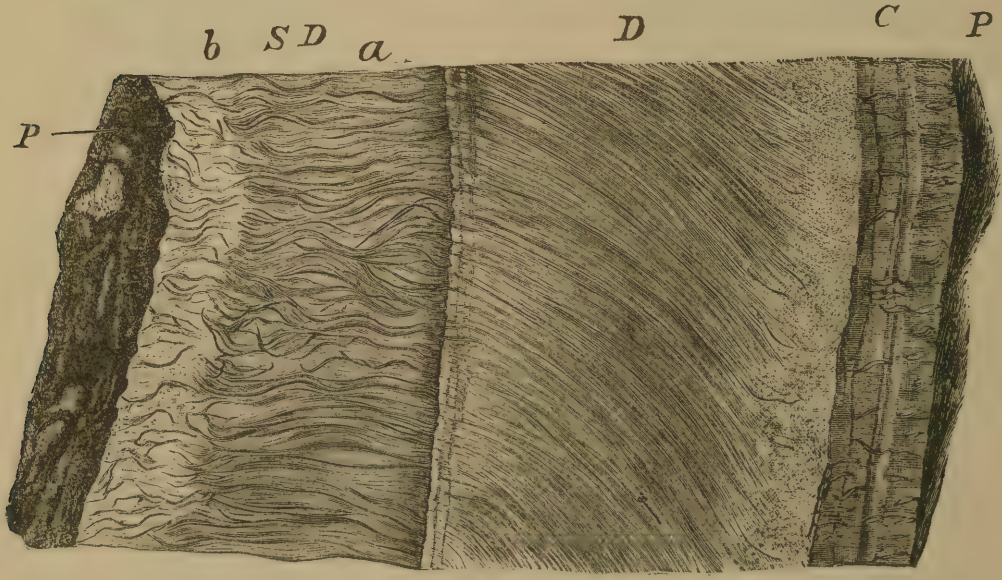
Fibers of living matter are not contained alone in the canaliculi of

primary dentine (Fig. 8, *D*); they can he traced along through the canaliculi of "secondary dentine" (if present) to the protoplasmic bodies of the pulp as well (Fig. 8, *S D*, *a* and *b*); the canaliculi "run in bundles" and run regularly distributed in their course in the primary (D), and regular and scanty in the (*a* and *b*) layer of secondary dentine.

The cementum is identical with bone; the lacunæ contain nucleated protoplasmic bodies—cement corpuscles—and from these, delicate offshoots of living matter extend into the canaliculi throughout the basis-substance, and this is pierced by a network of living matter which is in uninterrupted connection with the network in the dentine. "The dentinal fibers are either in direct connection with coarser offshoots of the protoplasmic bodies of the cementum, or the light network of the basis-substance of the dentine is in communication with that of the basis-substance of the cementum." Some of the offshoots of one cement-corpuscle connect with those of other protoplasmic bodies (*a*, *a*, Fig. 9).

Fibers of living matter from the cement-corpuscles connect through the canaliculi of the cementum with the offshoots of protoplasmic bodies (osteoblasts) in the pericementum. The network of living matter in the cementum is continuous with that of the pericementum and the fibers from the connective-tissue corpuscles—the protoplasmic bodies throughout the pericementum—connected with those of the ad-

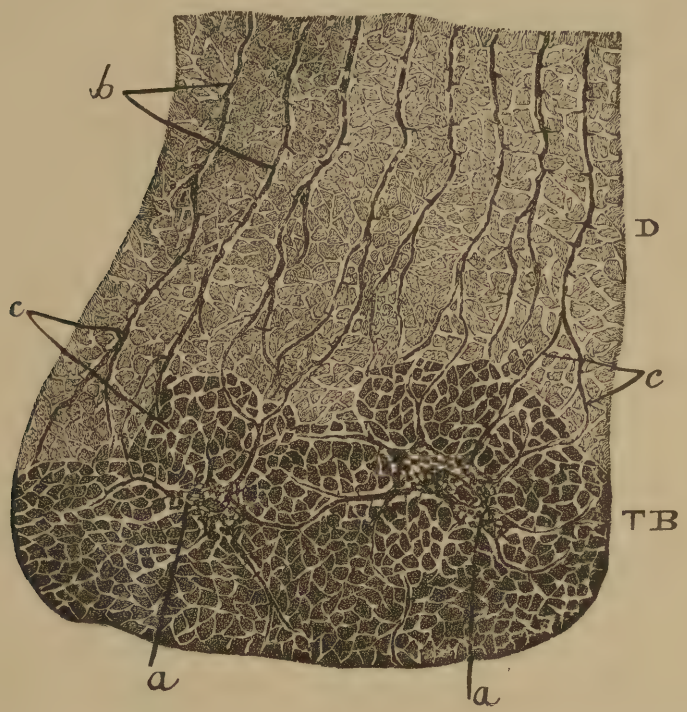
FIG. 8.



Section of root near apex of an anomalous cuspid tooth. *D*, dentine similar to that found near the neck of a tooth,—the canaliculi stop short of its surface and are replaced by coarsely granular basis-substance; *SD a*, first zone of secondary dentine; *SD b*, second zone of secondary dentine, with a portion of the pulp. *C*, relatively narrow layer of cementum with remnants of the pricementum. Magnified 300 diameters.

jacent bone-corpuscles of the alveolus; the living matter in the form of a reticulum is continuous throughout all these tisues.

FIG. 9.



Union between dentine, *D*, and cement, *TB*; *a*, *a*, cement-cerpuscles with large branching offshoots, connected with each other as well as with the dentine-fibers, *b*, at the bifurcation of the latter, *c*, *c*. Magnified 1200 diameters.

There are two varieties of pericementum, the myxomatous and the fibrous; the former is the connective tissue, covering the cementum of the teeth of young persons, and in the adult this tissue changes to the fibrous variety. In pericementitis there is a return of the fibrous connective tissue, to the embryonal condition. If the fibers of living matter connecting the connective-tissue corpuscles and forming the reticulum throughout the pericementum be not broken, the up-building of this or the formation of new tissue takes place through the course of embryonal to myxomatous, and then to fibrous connective tissue again. If the network of living matter be broken, the part torn ceases to be a tissue and pus is the result. After the healing of pericementitis there is not the same texture or grouping of the elements as at first,—a so called "cicatricial tissue" is formed in which there is a closer and more irregular distribution of connective-tissue bundles. Pericementitis is either plastic or suppurative; in the first a new tissue is formed; in the second, the fibers of living matter are torn; the part ceases to be a tissue, and pus-corpuscles form from the embryonal mass.

In the extraction and replacement of teeth for the "cure" of abscess, there is tearing and then may be imperfect connection of the fibers and network of living matter, so that were the minute structure of the tissues of the part properly understood practitioners who would resort to extraction for such a purpose would be able to bring about healing by keeping the organ to be operated upon in its place. Extraction of a tooth or root or destruction of a pulp should very rarely be resorted to, because of the tearing of the network of living matter, even if it be only of a part, for be it remembered that all the tissues throughout the body are uninterruptedly connected by very fine fibers of living matter in the form of a reticulum.

DISCUSSION.

DR. ESSIG.—My recollection of Dr. Bodecker's remarks is, that he referred only to his personal observations, and merely stated that he had never discovered during his microscopical investigations such an object as a vessel with a muscular coat in the dental pulp. He did not assert that there was not an arteriole present. I shall be glad to hear Dr. Webb's theory of how the circulation of the pulp is carried on.

DR. WEBB.—Dr. Bodecker has made many sections of pulps, and he has not seen an artery, or a vessel with a muscular coat, in any one of those sections. He is cautious in making statements, and this caution gives me the more confidence in him.

DR. DARBY.—I don't think Dr. Webb intended saying just what I understood him to say, that Dr. Bodecker was the first to discover the lacunæ and canaliculi in cementum and dentine. He probably intended to say that Dr. Bodecker was the first to describe the network of living matter in these. I agree with all he said about Dr. Bodecker as a careful, thorough histologist. I see no objection to the theory that the interglobular spaces in dentine may be, and are filled with the living matter, which under some circumstances may be calcified. The great difficulty in microscopical work, especially with the dental tissues, is to be sure of what you see. When specimens of enamel-tissue are prepared, they are usually ground on an emery or corundum-wheel, and into the structure of the specimen is ground dirt, etc., and the unpracticed and unskilled eye does not know what it is seeing. I do not for a moment question Dr. Bodecker's scientific knowledge in this direction. Dr. H. A. Moyer, of Kendallville, Ind., has recently sent me some very beautiful specimens of the dental tissues which he prepared and mounted.

DR. WEBB.—It has long been known that in dry specimens of cementum there are visible, simply, lacunæ and canaliculi. Dr. Bo-

decker observed that in fresh specimens each lacuna contains a nucleated protoplasmic body, which does not quite fill the lacuna; and from this protoplasm fibers of living matter extend into the canaliculi and basis-substances. An educated microscopist knows what he sees in the field he is examining; he can distinguish any foreign matter that may accidentally be present in the specimen. I have been in Dr. Heitzmann's laboratory, in New York, long enough to know that he requires his pupils to find out and state all that may be in the focus, and have also heard him criticise some students (both dental and medical) quite earnestly for imagining that they saw something when they did not. For instance, a medical student said to him one day, while diagnosing a case with the microscope,—"Doctor, I find that one must take a good many things for granted!" "No, sir!" said Dr. Heitzmann; "I don't allow any one of my pupils to take anything for granted in my laboratory. If I tell you that there is something in the focus which you cannot find, please mention it, and kindly allow me to show you." Dr. Heitzmann has been making a specialty of histology for fifteen years. Dr. Bodecker has been a pupil of his for four years, and is a very careful and thorough investigator. Not only this, but he started out with the great advantage given him by Dr. Heitzmann's long years of study.

Dr. Tees—Dr. Bodecker, in an essay upon "Pericementitis," in the December (1879) number of the Dental Cosmos, in treating of that form known as alveolar abscess, gives the *death of the pulp* as one of the results to which it leads. During a practice of many years, I have never met with a single case where there was swelling of the muscular tissues which was not the result of a devitalized pulp, and I never hesitate even in the incipient stage of soreness and elongation to drill into the pulp chamber in order to give relief. Systemic derangement or "catching cold," as it is commonly called, leading to this condition, alterative medicines are indicated. I prescribe podophyllin, with the tincture of capsicum and spirit of ammonia.

Dr. Darby.—Until five years ago, my experience was much the same as that of Dr. Tees. I would have said it was impossible for an abscess to form upon a living tooth. About that time a lady called upon me with an abscess which was evidently at the root of the first superior molar, or arising from a diseased state of its pericementum. Without the slightest hesitation, I commenced drilling through the masticating surface of the tooth (it had never been carious). After going a short distance towards the pulp, to my surprise I found the dentine sensitive, and farther on found a living pulp in the tooth. The abscess had arisen from irritation to the pericementum, caused by tartar which had been deposited far up under the gum upon the

root of the tooth. Since then I have met with several such cases, and am fully satisfied that teeth with vital pulps may have what I call *external* abscesses.

Dr. Essig.—I have a tooth in my own mouth around which I have experienced all the phenomena of alveolar abscess, and yet, from the manner in which it responds to cold, there can be no doubt of its full vitality.

Dr. Webb.—There is a difference between alveolar abscess and pericementitis around the neck of a tooth. Alveolar abscess is the breaking down of tissue into pus about the end of a root, while pericementitis (or "Riggs's disease") about and beyond the neck of a tooth is a suppurative inflammatory process, and necrosis of a portion of the surrounding alveolar border may follow. The first step for the cure of alveolar abscess is to get rid of the pus, which is a direct product from the inflamed part of tissue involved about the end of the root. Pericementitis (or "Riggs's disease") usually subsides after the thorough removal of calcareous deposits from the neck of the tooth, or the cutting away of the necrosed portion, if there is necrosis of the alveolar border.

Dr. Dixon.—I think alveolar abscess is very often the result of a dying pulp. I recently had a case of it where the pulp had been devitalized and the tooth had been filled for sixteen years, and never had given any trouble until this time.

Dr. Darby.—I do not believe more than one root in fifty is filled to the apex, when such an operation is undertaken. The failure is discovered when the teeth are split open after extraction. The best of men fail in their efforts to carry the filling-material to the apex. We all know that some teeth remain comfortable for years when no effort has been made to fill the roots. Many a devitalized tooth with a putrescent pulp within it remains comfortable, and the only inconvenience it gives the person is an occasional loosening when a cold is taken, or when from some cause the system runs a little below par. Whenever we find teeth with devitalized pulps it is our duty to remove the pulps, cleanse and disinfect the teeth, and fill as thoroughly as possible.

Dr. Webb.—In reference to the case Dr. Dixon speaks of, where abscess took place after the pulp-chamber had been filled sixteen years, I would say that a particle of foreign matter must have remained and been tolerated at the end of the root, until the normal standard of the health of the patient and the tonicity of the parts became lowered, thus favoring pericementitis and alveolar abscess. When the subject of the extraction and replacement of teeth for the cure of alveolar abscess was being discussed at a late meeting of the Odonto-

logical Society of Great Britain, Charles S. Tomes stated that "complete absorption of the roots is the accident to which replanted teeth are liable." Absorption is not an "accident," but an inflammatory result of the breaking down of the tissue occasioned by the tearing of the fibrous tissue and the network of living matter when extraction is resorted to. The absorption referred to is the dissolving away of the lime-salts in the basis-substance of the cementum, and the bay-like excavations are filled with protoplasmic bodies (myeloid bodies—"giant cells.") These excavations almost always result from pericementitis; new formation of cementum may take place, especially when extraction is not resorted to, and the fibers of living matter are not torn.

Dr. E. R. Pettit.—It is extremely important that we should determine before drilling into a pulp-cavity that the pulp is really dead or dying, or that the pericementitis is due to some other cause. A somewhat uncommon cause of this disease is the presence of nodules of secondary dentine in the pulp, the sharp spiculæ of which at times produce great irritation and severe pericementitis. I had once a marked illustration of this in a case which I diagnosed to be either a dying pulp or the presence of these nodules. As the tooth had no antagonist, and the patient was suffering intensely and insisted upon its extraction, I yielded to her desire and consented to remove it. In endeavoring to do so, however, I broke off the crown. After extracting the root I examined the pulp and discovered a sharp spicula of secondary dentine which I could move about with the pulp, and which doubtless was the sole cause of the trouble. The examination of the pulp of the adjoining tooth, subsequently extracted for the same cause, showed no signs of these nodules to the naked eye, but I had no reason to doubt the presence of minute speculæ, which the microscope would doubtless have revealed, as the severe pericementitis could be attributed to no other cause. The patient stated that she had lost nearly all of her back teeth from the same cause. I rarely ever attempt to preserve the pulp alive by capping, if there has ever been any pericementitis resulting from its exposure. Experience has taught me that such pulps will almost invariably, sooner or later, give trouble. I have also never, I believe, been able to preserve a pulp alive when it became so irritated by thermal changes or shocks through the filling as to become more sensitive to warm liquids than to cold. In every such case I believe it is better to drill into the pulp-cavity at once, especially if pericementitis accompanies it. But so long as the pulp remains more sensitive to cold than to heat, I am satisfied that it will return to its normal condition.

Dr. Webb.—I will try to give an explanation of the reason why

cold relieves pain to a certain degree, and heat intensifies it. When shock in healthy tissue takes place on account of cold, warmth restores the nutrient currents. For instance, if a large cavity be filled with gold without the dentine having been given such a protection from thermal currents as oxychloride of zinc affords, cold fluids shock the tissue, and the pain which follows usually ceases upon the application of heat. When anything irritates the pulp there is an increase in the neural and vascular currents to the part. Cold drives or keeps back part of the molecules of living matter and the blood-corpuscles, and ease for the time at least is secured. Heat induces acceleration of the currents, thus favoring the swelling of the granules throughout the protoplasmic bodies of the pulp, and those at the point of intersection in the network of living matter; the blood (the flow of which is increased by the warmth) in the capillaries so pressed upon the fibers of living matter, that the pain is intensified until the vessels are ruptured, and the fibers are torn at the end of the root.

The regular meeting was held Saturday evening, April 3, 1880, at the residence of Dr. H. C. Register, No. 1907 Chestnut Street. Dr. Register was called to the chair.

INCIDENTS OF PRACTICE.

Dr. Register.—I would like to ask the members of the Society if they have done anything in the way of grafting artificial crowns upon natural crowns and roots. Dr. Bing, of Paris, was, I believe, the first to insert a single tooth in this way, where the root had been lost. Since then (five years ago) I have increased the number to two, three and four teeth, and have just completed an operation of seven. I have met with but one failure. Dr. Webb performed an operation last summer before the State Society similar to the Bing plan, which consists of a bar entering two approximal teeth, which are supposed to be devitalized, the pulp-canal being used for anchorage. Now, for a single tooth, I do not think it necessary to let the bar enter two teeth, as both these operators do,—one tooth being, in my judgment, sufficient; but for any additional number it becomes a necessity. In fastening the crown or crowns, the bar should always enter the cavity, and be bent at a right angle, as the letter L; when more than one tooth is grafted, a right angle at *each end* of the bar, turned either way, is required; when this is built upon, it is held in all directions.

If the pulp is dead, this right angle should enter the canal; if alive, it should be in an opposite direction (towards the cutting-edge), and necessarily shorter. The method of fastening these teeth, is with either gold or amalgam, the mallet always being used with either material. Persons who wear them say that they can masticate with them, and entirely forget their presence in the mouth.

Dr. Essig.—Within a few days I saw a somewhat similar fixture, to which was attached seven or eight artificial teeth. A piece of platinum wire rested upon the cutting edges of the teeth; the extremities of this wire were secured by foil, packed into the crowns of the first molars on either side, and the bar was also anchored at other points in the canines. To this wire, porcelain teeth were soldered with pure gold, the backings being of platinum. The object of the fixture was to take the place of a small gold plate, made in the usual way, which the patient had previously worn, and which was supposed to cause a condition of redness and tenderness of the tissues upon which it rested, similar to that occasionally observed when vulcanized rubber is worn. It had been in position about two years. Two or three of the natural teeth upon which the wire rested, as well as those to which it was anchored, had decayed, and one or two were completely broken down. The platinum bar did not touch the gums, but rested upon the teeth in such a way as to allow the antagonizing teeth to bite upon it. It was a bold attempt to perform an extensive operation, and might have been successful, had it been properly done. It showed, however, hasty and imperfect manipulation. I have confidence in this method of fastening artificial crowns as performed by Dr. Webb, as thoroughness with him is a *sine qua non*.

Dr. Dixon.—Does any gentleman know the percentage of such cases in which Dr. Webb has been successful?

Dr. Longnecker.—I do not know the percentage, but he has been successful in a number of cases. I have inserted some myself, and secured them with oxychloride.

Dr. Register.—I use the electric mallet to condense the amalgam prepared in a dry manner. I use platinum pins and not gold; the mercury will eat away the latter.

Dr. E. H. Neall.—I wish to say a few words upon the manufacture and use of the hard rubber and corundum disk. My attention was first called to their excellence some seven years ago, by receiving a number as a premium for subscription to the *Pennsylvania Journal of Dental Science*. I used them with a great deal of satisfaction; they cut quickly and smoothly, and were especially useful in finishing gold fillings. Since then I have endeavored to procure others, but without success, as their manufacture soon ceased from some unexplained

cause. Disks of other kinds, such as the diamond, hard rubber, soft rubber, celluloid, felt, etc., can be obtained in abundance, but these are not for sale, to my knowledge. From several experiments which I have made during the last three months, I am satisfied that these disks can be made exceedingly thin, and can be used without danger of breaking, and will be found to outwear twenty of the ordinary corundum disks. I obtained the best results by chipping four dwts. black rubber very fine, and incorporating with it five dwts. No. 60 corundum with the fingers, while the rubber was softened in a small dish held over a Bunsen burner. After thorough kneading, small pieces were placed in moulds in the ordinary star flask, and vulcanized for fifty minutes., at three hundred and twenty degrees of heat, care being taken to bring up the heat to that point very slowly. This amount will be found sufficient for twelve large disks and points.

Dr. Dixon.—Have any of the gentlemen present anything to say as to their experience with the use of tin foil for fillings? My own observation of its results, especially in frail teeth, has so favorably impressed me that I feel anxious to hear from others upon the subject. I believe for many teeth it is better than gold.

Dr. Tees.—I have not inserted half a dozen tin fillings since I have been in practice. When it is not advisable to use gold, I prefer amalgam, oxychloride or oxyphosphate of zinc. I always fill temporary teeth with amalgam because it is easily and quickly introduced.

Dr. E. R. Pettit.—There are many cases in which I do not think we are justified in filling teeth with gold; as, for instance, the teeth of an extremely nervous child or woman, when the operation would be tediously long. In such cases the strain upon the nervous system is so great that I feel justified in using amalgam in preference to gold. The nervousness of the patient prevents a satisfactory operation, and in all probability a gold filling inserted under such circumstances will last no longer than one of amalgam, probably not as long.

Dr. Dixon.—I dislike to make use of amalgam, because it is objected to by many physicians; and some of them do not hesitate to speak disparagingly of those who use it.

The regular meeting was held Saturday evening, June 5th, 1880, at the residence of Dr. Daniel Neall, 1627 Summer Street.

Dr. Daniel Neall in the chair.

An essay was read upon

CONTINUOUS GUM WORK.

BY AMBLER TEES, D. D. S.

Notwithstanding the improvements in operative dentistry, during the past thirty years, so long as defective tissue and structure and other causes render the preservation of the natural organs in many individuals impossible, mechanical dentistry, even in its sphere of usefulness to the refined and intelligent, will not wholly decline.

It is only in relation to this class of the community that there really has been any decline. Our egotism and misapprehension of facts have led us to believe that this decline has been greater than these facts prove. In former years, leading dentists enjoyed a practice among all classes, and employed journeymen and students in their laboratories. The accession to the ranks of the profession of men devoting their time almost wholly to the insertion of artificial teeth, at very low prices, has caused a stampede of the masses, and hence the cry of the decline of mechanical dentistry. Instead of declining, such as it is, it is steadily rising, and, to-day, very few of "the people" over twenty years of age have not these ceramic pearls, *so white and so small.*

It is to be deplored that the tendency among the majority of our young practitioners of excellent ability is to ignore this branch of our specialty; whether from pride or laziness I cannot tell. These, above all others, should understand mounting the best styles of artificial dentures, in order that they or their assistants may be able to insert them for their patients; and I hope soon that one of the requirements of graduation at all our dental colleges will be the ability shown by a specimen set to successfully mount and insert a "continuous gum" set of teeth. When this subject agitates me, I am prone to believe that, whether dentistry is advancing or not, dentists themselves are degenerating; and the most healthy and vigorous are fast passing away—men who could successfuly dispose of a tumor, fill a tooth or make a false set; and, moreover, were not too fatigued to put in their ten hours or more a day. Now, the office hours are from 9 to 3, and then, instead of the apron and a few cheerful hours with the merry journeyman and the boy, it's "two-forty on the plank and off to Coney Island."

After an experience of over twenty years in the mounting of "continuous gum work," I fully believe it to be, in every respect, far superior to any other style. It is composed of materials of high conducting properties, so that after being in the mouth a few minutes, the heat is absorbed to the temperature of the blood, and transmitted to the oral cavity, thus preventing the gum from being "bottled up," as is the case in mouths in which teeth mounted upon the hardened vegetable bases are worn. Those who contrast these conditions, cannot fail to be impressed with the healthy appearance encouraged by the metallic plate, and to the inflammatory, even in many cases to the disfigurement of the tissues caused by the vegetable. The teeth, being arranged separately, can be made to conform to the unequal absorption of the process, as well as in an upper set to the irregularities of the lower teeth, the gum being afterwards made to conform to these positions. The color of the gum being a close resemblance to nature, and of various shades, gives to the whole such a life-like appearance that detection, even on close inspection, is almost impossible. Its weight, the principal objection urged against it, as the experience of those who wear it proves, is counteracted by the pressure of the atmosphere, even when there is only an ordinary adaptation. The platina, being soft and pliable, is easily swaged, and this respect has an advantage over gold and silver. It is my wish in this paper to throw out a few hints, for the encouragement of those who are already engaged in its manufacture, and for the enlightenment of those who contemplate doing so.

Platina, which is used for the base plate, is a very useful metal in our specialty. It was discovered by the Spaniards in 1741, and given the name of *platina* (little silver) on account of being found in the form of granules, rounded and flattened. This name is still used by the majority of dentists who have occasion to employ it. But chemists and, lately, a few dentists give it the appellation of *platinum*, an arbitrary name, and inconsistent with the present nomenclature of the metals. Prof. Cooke, in his "Principles of Chemical Philosophy," page 101, says: "The names of the elements are not conformed to any fixed rules. Those *which were known before 1787* retain their old names, such as sulphur, phosphorus, arsenic, antimony;" and, he might have added, cobalt, *platina*, nickel, manganese, and tungsten, discovered about the time of and after platina. It is evident, from this, that chemists and others have blundered into the use of the word platinum. The old Spanish word platina, I prefer. It has a sweet, soft sound, and, moreover, is the name associated with many improvements in dentistry, being eminently a dental name, used solely, no doubt, until long after Sir Humprhey Davy suggested, in

the beginning of the present century, the application of the Latin suffix *um* to all new elements.

For several years I have discarded plaster for taking impressions, preferring pure yellow wax. I had two reasons for doing so: 1st, Plaster at the operating chair is uncleanly, of a disagreeable taste, and small particles are apt to fall into the throat. 2d, In the case of a hard palatine ridge, with the neighboring parts soft, and in other difficult cases, a plate made from a plaster impression seldom fits the cast, being a perfect *fac simile* of that portion of the mouth. The wax presses upon the soft parts and yields to the hard, thus giving a plate which will not rock. An impression cup of the proper size should be selected. The wax should be carefully softened to a plastic consistency, care being taken not to over-heat it; and when it is over-heated, not to pour cold water into the hot in order to lower the temperature. If this is done, an imperfect impression will be the result.

In preparing the plaster model for the rim, care should be taken, both in the upper and lower, that the plate does not extend too far over the alveolar ridge, so as to impinge upon the insertion of the muscles. In the upper it will produce irritation of the mucous membrane; and in the lower, both irritation and dislodgment of the plate from its proper position at each motion of the tongue and cheek. If this hint is taken and acted upon, lower plates especially will be more comfortable, lying upon the narrow portions of the ridge almost as securely as if attached with clasps to the natural teeth; filing and burnishing the plate, after being finished and worn, will be done away with, it only being necessary, in case of irritation from a plate thus neatly adapted, to use a local application of phenol sodique and cold cream for a short time, when the inflammation will subside.

If the plate does not adhere to a mouth with a high roof and a prominent palatine ridge, scrape away a little of the plaster ridge each side of the palatine ridge and back of the chamber, and burnish the plate to conform to it. If this does not answer, turn down the edge of the plate so that it presses firmly against the gum; the plate, back of the chamber, to the width of an eighth of an inch, should then be left bare, when the body and gum is put on, to allow of any further change which may be made necessary when the plate is finished. The majority of these cases cannot be adapted without manipulation, and platina is so soft that it can be readily manipulated, when, with any other base, the undertaking would be fruitless.

In articulating the teeth, the upper and lower front teeth should not be allowed to touch. The teeth should be placed, as a rule, over and a little to the inside of the lower plate. This will aid materially in preventing the rocking of the plate, and, in many cases, where at-

mospheric pressure is but slightly available, make mastication easy. In this way, in several instances, patients have been enabled to masticate at the first meal after their insertion, although, for a long period they have worn plates which were useless in this respect because the rule was broken, either from a desire on the part of the dentist to give them *tongue room*, or from an eagerness to restore their youthful appearance by making plumpers of the bicuspids and molar teeth.

In grinding the teeth use as much care as with gum or plain plate teeth. If a mistake should be made in grinding or clipping off too much of a tooth, make a "dutchman" of platina clippings, before the body is applied and carved. This precaution will prevent the shrinkage of the body, disturbing the teeth in their positions.

In the majority of cases, I prefer "long bite teeth," or teeth with the palatine surface approximating the natural length, made from moulds conforming to the shapes of the natural teeth, which are now made for this work by Johnson & Lund, S. S. White and Justi. In arranging them, the same taste should be displayed towards surroundings—color of the eyes, complexion, length of lip, fullness of the gum —as that of the portrait painter. For the sake of conscience and reputation, a set that disfigures the patient should be thrown away.

In partial lower sets, the connecting band should be strengthened with a piece of platina and iridium No. 26. These sets are much more comfortable, and keep in position just as well without clasps, if the insertion of the muscles are not impinged upon.

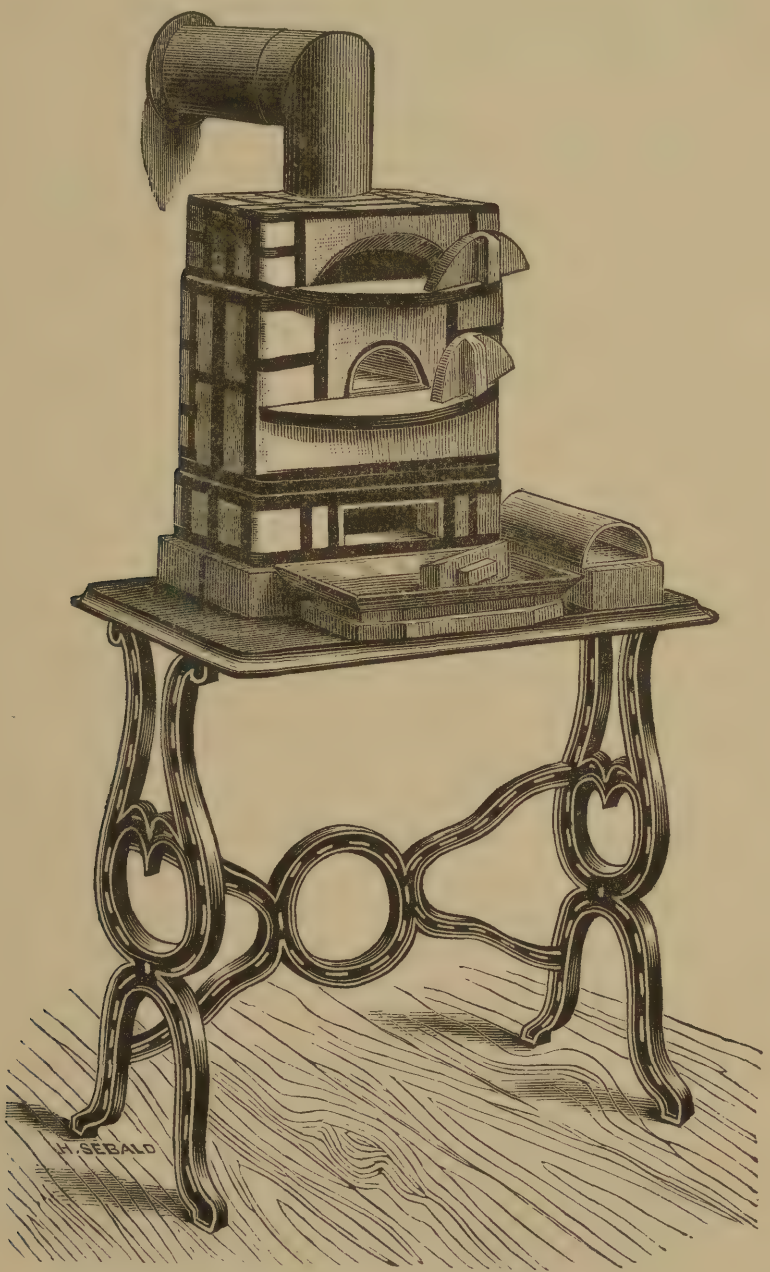
Before inserting the teeth in plaster and asbestos, remove the wax from between the necks of the teeth, and coat them with pure shellac varnish as thick as cream. When dry, cover with plaster alone to the depth of an eighth of an inch, working it in between the necks of the teeth. This will prevent etching of the teeth, and keep them firmly in position while the band is being fitted.

When soldering in the muffle, take the set out as soon as the gold is melted. If allowed to remain in too long the teeth will be apt to etch. If, however, these precautions do not prevent this trouble, the first coat of body should be subjected to such a degree of heat as will again melt the enamel.

After the first coat of body is put on and carved (by means of a spatula or needle) a separation should be made between each tooth. This will prevent the shrinkage of the body in baking, from drawing the teeth out of position and spoiling the articulation.

In preparing the fire, after the first two or three shovelfuls are ignited fresh fuel should be placed around the muffle, so that the highest degree of heat can be obtained. Insufficiency of heat is the cause of the cracking of the gum. At a high temperature the gum can be

fused, the set removed from the hot muffle and quickly cooled in a cool one, of the warmth of the room, without cracking the gum; whereas, if fused at too low a temperature, and allowed to cool in the hot muffle and remain there for a day, even, the gum will be full of cracks.



The furnace which I had the pleasure of showing you at the March meeting is the result of experiment on my part, to get the proper degree of heat with the expenditure of the least amount of fuel. It being square, and but 14½ inches high, 12 inches wide and 8 inches deep, the heat is economized, and excepting the hottest weather of summer,

a room twelve by twelve will not be uncomfortable for the workman to remain in; and even then the temperature is raised, if there is a good draft of air through the windows and door, but ten degrees.

It is my intention to give my personal attention to the introduction of these furnaces, trusting that it will cause a revolution in mechanical dentistry, and end in giving refined, generous-hearted people, whether rich or poor, life-like and health-preserving artificial teeth.

Discussion.

Dr. D. Neall.—In the construction of artificial teeth, tact is a great necessity, since leverage is very often sacrificed to contour. I have no trouble in taking plaster impressions. There will be no bubbles if it is thoroughly mixed, and properly applied. It is often used too thick. I have no trouble in soiling dress or chair with it, nor do I allow it to fall into the passages of the throat. At my age, I still enjoy and find recreation in mechanical dentistry. I prefer hard rubber to any other base, since I can get a better fit with it. I was unexpectedly successful a week ago in fitting a flabby mouth, the mucous membrane and tissues generally resembling sponge, by pressing back the gum and forming an artificial compressed area.

Dr. James Truman.—I am gratified that Dr. Tees can feel so much faith in the future of mechanical dentistry; but, judging its future from its present and past condition, I cannot feel so sanguine of a better state of things. If a change is to come, it must be through the devotion he and a few others have exhibited in maintaining a high standard of perfection. I cannot, however, unite with him in his opposition to the use of plaster for impressions. An experience of a quarter of a century in its use, has confirmed the opinion that there is nothing equal to it in accuracy in the whole range of material at our command. In the majority of cases, wax, the "modeling composition," or even gutta percha may be used with good results; but they fail, or have failed in my experience, just where we most need perfection in a class of mouths with yielding tissue. By the use of partially unyielding material, the soft tissue is pressed out of position, which acts on the plate, subsequently inserted, as a spring, causing it to drop. The insertion of plaster in a semi-fluid condition meets this difficulty, and we have a correct impression, with the least possible change in the tissues. Where it is unnecessary to use the plaster in hard mouths, I much prefer the "modeling composition," and, in practice abroad, made use of this material almost to the exclusion of plaster, in the cases just cited. Wax, in my judgment, occupies the lowest place in impression materials.

Dr. E. H. Neall.—I have examined a number of specimens of

"continuous gum work," made by Dr. Tees, and can say that, for life-like appearance and artistic finish, they are superior to any I have ever seen. With regard to their practical advantages I cannot speak, as I have always considered their weight an insuperable objection, and have consequently advised and used some lighter material. I regard pure yellow beeswax as a good thing in itself, but a very poor material for taking impressions, chiefly on account of its yielding quality; and I do not see how an accurate impression of the mouth can be obtained by its use alone. The method of using a metal cup filled with plaster I also consider objectionable, being uncleanly and liable to produce nausea in many cases, on account of the difficulty of judging the exact amount of plaster required. The plan I have practised for many years I learned from my father, who used it with success for a quarter of a century. It consists in taking a good impression in white wax, and cooling it in ice-water; it is then trimmed down to the size required with a heated knife, and carefully dried. A tablespoonful of plaster is then mixed to the proper consistency, and spread upon the wax cup, and placed in the mouth. This will insure a good impression, even in a case where the palatal arch is very high, as the plaster, being evenly spread upon the wax, and being quite thin, there is no danger of its settling from the mouth. In cases where the plaster clings to the mucuous membrane, a little water thrown from a syringe about the margins of the impression, will aid materially in its removal. This method of taking impressions, like all others, requires considerable practice and careful manipulation, but I think will be found in a great majority of cases, a satisfaction to patient and operator.

Dr. Tees.—Facts are stubborn things. In many cases I have been successful with wax impressions where plaster ones have failed. Unless the plate presses upon the soft parts, the air will force its way again into the cavity almost as soon as it is exhausted from it. For this reason a plate, as it leaves the zinc cast, adheres much more firmly than if it fits the plaster cast perfectly. The shrinkage of the zinc at the alveolar ridge causes the plate to press upon this portion of the gum, which is soft and yielding, and relieves undue pressure upon the palatine ridge, thus preventing the rocking of the set of teeth.

Dr. W. H. Trueman.—Since the discussion has drifted into taking impressions, I desire to call attention to the use of ox[illegible]-phosphate cement for taking the impression of roots, where extreme accuracy is required as in some processes of pivoting. I have adopted the use of metalic pivots almost exclusively, and lately have set a number, by first fitting a cap tightly over the root on which I set the tooth. The idea is borrowed from Dr. Richmond's arrangement of bicuspids and molars, and in small or weak roots I think it will give greater security, and

prevent them splitting. It has the disadvantage of the band of gold showing in some cases quite conspicuously. In these arrangements extreme accuracy is essential. This I have secured by fitting a gold ring accurately to the root, and after adjusting the gold pivot to its place, packing between the ring and the pivot oxy-phosphate cement, first oiling the root. This sets quickly, and firmly holds the ring and pivot in place while it is being removed from the mouth. In one case I desired an accurate impression of a root and a cast of it, that would bear more rough usage than plaster; this I obtained by packing the impression of the root with amalgam and allowing it to stand over night, and then completing the cast with plaster. I very much prefer plaster to wax for taking impressions, and only use wax around the teeth in partial cases. Still I know a dentist who always took the impression of partial cases in wax, and very rarely indeed made a misfit. He took the impression in the ordinary way, removed it before it had become hard, and after trimming off all surplus wax, replaced it in the mouth. I have tried the same plan, but utterly failed. In such cases I take the impression of the teeth in wax, and the roof of the mouth in plaster in one impression. In soft mouths I use the plaster very soft, my idea being to get an impression of the mouth in its normal condition, and to carve the cast where I desire the plate to press harder, rather than use a material that will press upon the soft parts. In this, as in a great many other things, success is more due to *practice* and *judgment*, than to the material and method we use.

Dr. J. A. Woodward.—The success of Dr. Tees with wax impressions may be due to his personal execution of the work, and not dependent upon the material in which the impression is taken. For entire sets I prefer plaster; for partial sets and regulating fixtures, the modeling compound. In the employment of plaster, a certain lot should be set aside, for this purpose, secured from the atmosphere in tin or glass—after being assured by trial that it sets properly. We should wait until it parts with a sharp fracture, and then withdraw it from the mouth; to wait longer may cause inconvenience in removing it. The furnace exhibited by Dr. Tees at the March meeting is very compact and so small that there is no waste of fuel nor unnecessary heat to be lost in the room in which it may be placed. Those who make the "continuous gum-work," will certainly find it more satisfactory than the larger furnaces.

Dr. E. R. Pettit.—I desire to call the attention of the Society to the new anæsthetic, the bromide of ethyl. This has been used by Dr. R. J. Levis at his surgical clinics at the Jefferson Medical College and the Pennsylvania Hospital for more than a year with favorable results. To produce anæsthesia with this substance, occupies scarcely more

time than with nitrous oxide gas, while its effects last longer, but yet pass off quite rapidly, leaving no unpleasant after-effects. Should greater experience with its use prove its administration to be as safe as either nitrous oxide or ether, it will prove a great boon to the dental profession, as it seems peculiarly adapted for such minor operations as dentists are often called upon to perform. I take great pleasure in presenting to the members of the Society a pamphlet written by Dr. Levis, which gives full information in regard to its administration, effects and advantages.

The regular meeting was held Saturday evening, October 9th, 1880, at the residence of Dr. S. H. Guilford, 4006 Chestnut Street.

Vice-President Dixon in the chair.

Dr. Guilford addressed the meeting extemporaneously on

INCIDENTS OF FOREIGN PRACTICE.

He said that he had been abroad too short a time to learn all that was to be learned about the practice of our profession in another land, but that even six months was long enough to learn many facts about it, and these facts he thought the members present might be interested in listening to. His observations had been, of course, confined to France, and so all he had to say on this subject, he wished understood as applied to that country alone. He said we were all accustomed to hear, from time to time of the wonderful strides in dental science in our own country, and how greatly we had outstripped other nations in this respect; but the full truth and scope of this statement could only be realized and appreciated by any one after a residence and practice abroad. Less than a hundred years ago, he said, a few men in this country received their first practical knowledge of dentistry from a Frenchman named Le Maire, and an Englishman by the name of Whitlock, who, by fate or good fortune, had drifted to these shores. They knew little of the art, but that little seemed a great deal to the few Americans who knew less. To-day how great the change! France, in three hundred years, has gained but little in practical skill, and England not much more; while America stands the acknowledged mistress of the world in the manipulation of this, for some time trade, but now profession of dentistry. There are, no doubt, many reasons for this peculiar instance of a pupil outstripping his teachers, but two prominent ones are easily recognizable. One is the practical turn of

mind and natural faculty of invention of the native American, which has led him to leave to others largely the investigation of the theory and cause of the evils existing in the oral cavity, while he devoted himself more immediately to the more practical part of their correction. The other is the liberality which characterizes the members of our profession here, leading them to associate together for the interchange of ideas, and this in turn leading to the establishment of dental colleges, where the best of instruction is freely imparted, at a price barely sufficient to cover the expenses of conducting the institution.

About forty years ago, dentistry had already advanced so far in this country that a few of our best men determined to seek new fields of labor in foreign parts. Being good men and skilful, they soon succeeded not only in reaping a large pecuniary reward for themselves, but also in shedding professional lustre upon the land from which they came. Their success led others to follow their example, until to day there is scarcely a civilized country upon the face of the globe where American dentists are not to be found in all the chief cities. Wherever they are, they seem to be held in the highest esteem, and their services are almost universally sought in preference to those of their competitors who are "to the manor born." The preference for American dentists, so long and patiently endured by French dentists, is at last beginning to excite their jealousy; and they are endeavoring to bring about such legislation as will prevent foreigners from practicing there, unless they hold diplomas from the Paris College of Medicine, just as is now the case with physicians. The high reputation which we enjoy everywhere abroad is most gratifying and flattering to us, and we are indebted to it for the fact that the first men who went abroad to practice were representative men. So many have gone abroad of late that perhaps quite naturally there are among the numbers many who have not stood in the front rank at home, and who, it is to be feared, will not add to our national reputation where they go, but will rather detract from it in the course of time.

Dr. Guilford mentioned the fact that while we have here many colleges for the instruction of beginners, England has but one, and the rest of Europe, so far as he could learn, none. France has not even yet a regulary-organized dental society. While he was in Paris, the first meeting of dentists took place there, for the purpose of having the different members of the profession in that city become acquainted with one another, with the intention that this meeting should lead eventually to the organization of a dental society; and that ultimately result in the establishment of a dental college. Before this meeting, he was told the great majority of dentists there did not even know one another by sight.

He found that while the native French dentists were reasonably skilful in the mechanical branch, they were very deficient in the operative. With them the insertion of a good gold filling seemed almost an impossibility. They preferred to work with the plastics because of their greater success with them. Among these, the oxy-chloride of zinc and the oxy-phosphate seemed to be the favorites, just as amalgam is in the British Isles. The largest dental dealer in Paris told him that he sold more of the zinc plastics to them than any other filling material.

In the mechanical line rubber seemed to be with them the favorite base; and while they also did a great deal of gold work, they had not as yet taken much to the use of celluloid. The prices obtained there for mechanical work are quite large, and quite out of proportion to the small prices they charge for operations upon the natural teeth. Of course the French dentists have eminent men among them, such as Rottenstein, Magitot and others, but they are men who are noted not for their skill in filling teeth, but their pathological researches and writings, and their attention to the surgery of the mouth.

The speaker said he was quite struck with the devotion of the French people, generally, to their professional advisers, and that once having placed themselves in their hands, they were very slow to have or make a change. On this account a French practice grew to be a very real and permanent thing, and was as easily turned over to a successor as any other business. People there are in the habit of employing the same dentist and physician, or their successors, as their fathers or grandfathers were in the habit of going to. Different from us in this respect, where a successor, in buying a practice, does not know how many of his predecessor's patients will come to him, with them their practice posseses a real money-value, for they feel sure that if they can only retain their predecessor's name, the same way and the same office, the patients will come to him just as they did to the one who went before him. He often heard dentists speak, while there, of the selling value of their practice. As to the quality of teeth possessed by the French, and their liability to decay, the speaker said that he found them generally very much injured by neglect; still, so far as his observation went, he found the quality of teeth good, perhaps a little better than the average of teeth in this country.

Contrary to his expectations, based upon what he had previously heard from others, he found the French to be very good patients, indeed, at least such as it fell to his lot to work for. They sat patiently, were much interested in the many things that seemed new to them, bore pain quite bravely, appreciated all you did for them, paid their bills cheerfully, and last, but not least, thanked you very profusely for your kindness in serving them.

All in all, his short professional experience with the French people had been an exceedingly agreeable one in all respects.

At the close of the speaker's general remarks, he exhibited to the Society a blow-pipe sold by Ash & Son, of London, which for simplicity of construction and effective power, he had never yet seen equalled. He also showed some platinum wire, slightly alloyed with some other metal (iridium, possibly) gotten up by the same firm, which he found to be very useful in pivoting operations. Some impression cups that he had brought with him, and that seemed particularly adapted to their special use, were also shown, together with some rubber strips for separating, different from anything of the kind to be had in this country.

Dr. James Truman.—The remarks of Dr. Guilford, in relation to dentistry in France, apply with equal force to Germany. The theoretical education there is, in most respects, equal, and in some directions, superior to that usually held in this country, but the practice is immeasurably inferior, so bad, indeed, that I doubt whether at any time in the past fifty years, it has been as defective here. I allude now to the mass of practitioners. There are a few earnest and able men who are exerting every means in their power to elevate the profession, but, so far, their efforts have not availed much, and I fear are not likely to give better results, unless a higher standard of remuneration could be established, which, in the present condition of things, appears hopeless. The low fee bill destroys ambition to do superior work, and, in fact, degrades the work itself. Germany is truly a poor country, and it will probably remain impossible for the masses to pay prices warranting the necessary outlay of time and skill found requisite in this country. The operations in gold that are daily performed here would there be simply impossible. While this is true, it does not excuse the miserable work everywhere apparent. The German mind runs naturally to specialties. The idea enters into their educational life; the boy is fixed for his future at a very early age, and his education is arranged to meet this future. Very little, if any, attention is bestowed on the natural inclinations of the boy, it seemingly being supposed that the training he will receive will take the place of natural talent. The result is as might be anticipated, the majority getting into places unsuited to them. In anticipation of the work in life, the boy is sent to that school best adapted for his future needs. The doctor, lawyer and clergyman go to the gymnasium. Those intended for practical pursuits, such as civil engineer, etc., to the Real Schule, and the common people to the Bürger Schule. The first is purely classical, the second omits the classics, excepting Latin, devoting more time to modern languages and mathematics, and the latter gives only a plain education. The education proper, as we understand it, ends in each

of the institutions, and the University receives the professional man, the polytechnic, the practical civil engineer, &c., to prepare for the business of life; and in many cases the individual is not prepared to begin this life until thirty years of age. To the time spent in study must be included that in the army. That this large amount of time devoted in a degree to theoretical subjects has an injurious effect in the acquisition of practical ability, must be self-evident. So much of our professional labor is purely mechanical, that manual dexterity must be acquired young.

There are two classes of dentists in Germany—the mechanical (zahntechniker) and the dentist (zahnarzt). The first has never passed the government examination, and cannot perform any operation regarded as surgical. He can make artificial work, insert fillings, but he must never call himself zahnarzt without incurring the penalty of an outraged law. The zahnarzt proper is supposed to be a very learned man, and capable of performing all that appertains to the profession, but, in my observation, he never hesitates to make a plate over roots, nor does he, as a rule, regard the filling of these roots as a matter that concerns him in the slightest degree. He deals largely in amalgams and phosphate of zinc, and a great improvement might be made in the insertion of these. He is remarkably jealous of his professional colleagues, and, if it be an American dentist, does not hesitate to ask the aid of the chief of police to drive him from his neighborhood; in a word, there seems to be but a moderate degree of that *esprit de corps* so prevalent with us. They have a national society, and several local organizations, but they have, so far, failed to break up that self-isolation and intense jealously that exists, and until this is done progress is impossible. There is an effort being made to establish dental schools, but as these, to be of any value, must be connected with the universities and under government control, it is not probable they will soon be an accomplished fact. An innovation upon established custom like this will require at least a generation before it can be acted upon. There exist some feeble attempts at teaching, but they have never risen to the dignity of schools.

The mechanical work in Germany is about up to the average, as far as skill in manufacture is concerned. The constant insertion of plates over roots, with all its disgusting results, necessitates the use of springs, and nothing so much strikes the American observer as the materials in the dental depots for this antiquated mechanism.

The literature of the profession there is, on the whole, very good. It is to the credit of the dental mind in Germany that it does not wrap itself in a national self-conceit, but fully acknowledges the claims of other nationalities. Some valuable original works have been published, and the journals vie with each other in giving their

readers the best thoughts at home and abroad. The *Deutsche Vierteljahrsschrift fur Zahnehilkunde* has always been ably edited, and sustains its deservedly high reputation under the care of its present editor's pen, Dr. Baume. The *Correspondenz Blatt* is made up entirely of translations, the larger portion of which are from the journals of this country. The *Zahntechnische Reform* is the organ of the mechanical dentists, and is especially noticeable for the aci lity of its editorials, especially when dealing with American colleges. The *Monatschrift fur Zahnpflege* and *Zahntecknik* endeavor to combine, to a limited extent, all branches of the healing art.

The materials used in dentistry continue to be mainly manufactured in this country and England, though that of instruments is carried on to a considerable extent, but they do not compare with those made in the United States. The manufacture of gold foil has been commenced by a firm in Bremen, and from a limited experience with it should regard it quite equal to that made in this country.

Dentistry, as practiced by Americans, and by some educated here, stands on a different footing from that of the German practice. Its aim is higher, and the results are in proportion. The American operator is cut off, however, from nearly all association of a professional character with his German co-laborer. Having little or nothing in common they cannot pull together, and, as far as my observation extends, do not attempt it. I regard the standard of American dentistry abroad quite up to, if not above, the average of that at home. Though entirely isolated, except in the very large cities, the ambition to excel is maintained by a constant interchange of patients. The American traveller looks up his dentist about as regularly as he does his hostelry in each new city visited. The result is a constant supervision over each other's work. This takes the place, in a large degree, of more intimate intercourse, and possibly reaches as good or even better results. They have their own separate organization.

Dr. Kingsbury.—I have taken a special interest in the remarks of Dr. Guilford, as they vividly remind me of some of my own impressions and experiences while travelling through Europe and the East some years ago. My visits to the native dentists, and the acquaintance I formed with them, although necessarily limited, convinced me at that time that they were, in many respects pertaining to their profession, considerably below the standard of the reputable and experienced dentists of our own country. I will mention a case in point that occurred during my visit to Beyrout, Syria. Beyrout contains a population of some six thousand, a large proportion being English, French, German, &c. Soon after my arrival there, I was called on by a Turkish gentleman connected with the American Mission and College, who wished to consult with me in regard to his teeth. I found that

he was wearing a full artificial denture of hard rubber, and that it caused him great trouble and suffering. It was obvious that the defects were so radical as to require an entire reconstruction of the dentures, both upper and under. Upon stating this fact to him, he desired me to make the dentures for him. I replied that I was travelling, not professionally, but for my health and pleasure; that I had no dental instruments with me, and that it would be impossible for me to serve him in that way; but if he would bring his dentist to see me, I would consult with him, making such suggestions and rendering such assistance as would enable him to make great improvements on the set he had. The next day he called on me, in company with his dentist, whom I found to be an Austrian, from Vienna—a gentleman of culture, with a medical education, but quite deficient in some respects as a practical dentist. He was very cordial, seemed glad to see me (having seen my name in connection with the Philadelphia Dental College), and was gratified for the advice and aid I gave him.

I made an appointment to meet the patient at his office, where I took the impression, and so directed the construction of new dentures that before I left the city the patient was in possession of dentures that he found to be a great improvement upon his former ones. He seemed delighted, and subsequently called at my hotel to express his gratitude, and to prevail on me, if possible, to remain and practice my profession in Beyrout, engaging, if I would do so, that I should have all the business I could desire. I was obliged to decline his urgent invitation, thanking him for his appreciation of American dentistry, stating that I had a practice and professional interest in my own country, that I could not be persuaded to leave. In Zurich, Switzerland, I found that a young American dentist, Dr. Senel, was building up a most successful and lucrative practice. I found another American dentist at Florence, Italy. At Rome I called on Dr. Buridge, an American dentist, who enjoyed the reputation of being a fine operator, and was patronized by the Roman nobility and foreign residents.

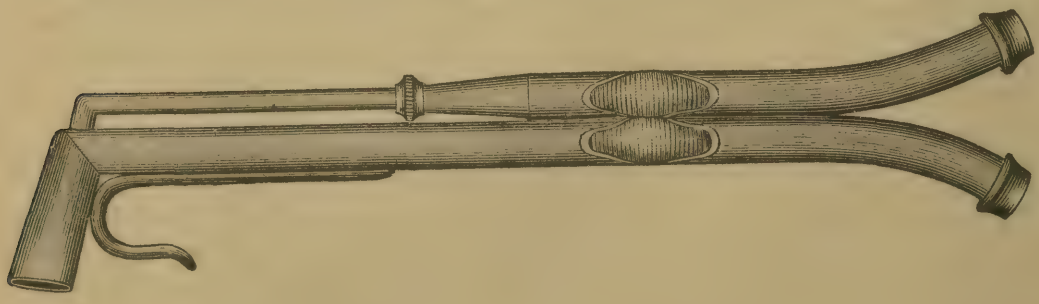
For many years Dr. Brewster was the representative of our profession in Paris, and was immediately successful. It is probably known to most of you that it was with him that Dr. T. W. Evans became associated in practice, on his going to Paris some years ago; and no doubt to this fact, in part, as well as to his professional skill and personal merit, Dr. Evans is indebted for his unprecedented success. Probably no professional man, surgeon, physician or dentist, ever received the patronage of so many crowned heads, princes, nobles, and persons of distinction and great wealth, as the American dentist, Dr. Thos. W. Evans, of Paris. His fees have been fabulous, and the emoluments of his practice have been so large, that his present wealth

is estimated by millions. During my visit to Paris, in 1867, Dr. Evans was very cordial, and extended to me many acts of professional courtesy and personal kindness, which I fully appreciated, and to which I take pleasure in bearing my grateful testimony at this time. Dr. Gage was another American dentist, at that time enjoying an enviable reputation and success in Paris. In consequence of bad health, he was obliged to give up his practice, which was worth some $20,000 a year. Dr. Dubouchet, of our city, negotiated for his practice, and became his successor, retaining most of his patients. Europeans seem to possess stronger local attachments than our restless, migrating American people. The dentist who buys out the good-will and practice of a European dentist, will be very likely, in case he is competent, and can be strongly recommended, to retain all or nearly all the patients of his predecessors. Patients do not become scattered as they do in American cities.

The time may have gone by when American dentists can find such openings for practice as were found by Brewster, Evans, Gage and some others. But thirteen years ago there were great inducements offered to American dentists to open offices for practice in various cities of Europe. And I have no doubt of there being many most desirable opportunities for them at the present time, not only on the Continent, but even in England, inasmuch as students from all nationalities come to the dental colleges of the United States of America for their education. I think the presumption is fair, that it remains for American dentistry to supply the needs of the world, as it regards dental practice, to a large extent.

Dr. Darby.—I have never seen a delicate dental instrument that was made abroad, unless, perhaps, I except the separating files made in Paris. If you examine the plugging instruments made and used in England, you will find them large, clumsy affairs compared with those made and used in America. I am of the opinion that all the finer, better class of instruments used throughout the world are made in this country.

The blow-pipe brought over by Dr. Guilford is a very good one, in fact the best thing of the kind I have ever seen. The heat than can be produced by it is intense, and the instrument is easily controlled.



The regular meeting was held Saturday evening, November 6th, 1880, at the office of Dr. Darby, 1513 Walnut St. The following paper was read upon:

CLIMATE, FOOD, AND ASSOCIATIONS, IN THEIR RELATIONS TO TOOTH-STRUCTURE.

BY JAMES TRUMAN, D. D. S.

The prevalent idea that teeth vary according to climate, food, etc., is probably a very true one, and needs no argument at this late day to advocate or refute it; but to what extent this variation takes place in teeth, more than other tissues, is not clearly indicated. In fact it is a subject encompassed with difficulties. Dentistry is too young and the trained workers too few, and the statistics collected from professional sources too meager, to arrive at any definite conclusions. It is therefore only possible to skim over the surface and, perhaps, glean a few facts, leaving the results to the future for that correction which must necessarily come from more positive observation. That climatic influences have largely to do with the formation of tissue is axiomatic, and would seem to need no words to make it more self-evident, but the processes by and through which this is effected are by no means so clear. They enter into the realms of mysterious influences that operate to evolve life from the minutest atom to the fully-developed animal; from the unorganized protoplasm to the almost Godlike mentality of man. Until we can define what the correlation of forces really means; until we can fathom the mysterious border-land, which no microscope has ever penetrated, we must grope in profound darkness. Here observation ends and theory begins, and yet behind this theory, in the illimitable void, lies the true home of the forces, which aggregated, create life and lifeforms wherever we find them. The most powerful forces are the intangible. We call the fall of bodies to the earth the force of gravitation. We recognize the fact that the universe is held in position by a power invisible and incomprehensible to the human intellect. The world of causation lies beyond our present reasoning powers or our most powerful objectives. We recognize certain effects, but the causes are shadowed in the realms of mysterious life.

Whether we view life in the concrete or examine it in its simplest forms, we are impressed with the fact that the laws of formation are everywhere imperiously present, and that atoms, organized or unorganized, are but the creatures of influences which, through all apparent aberrations, are resolved finally into harmonious relations. While we may formulate the law into words and say, evolution is progressive development, we are met at the beginning of our inquiry by apparent

contradictions,—contradictions which the few thousand years accorded us for observation have failed to clear up. The apparently unchanging color of the different races of men, and their typical forms, continuing through successive ages, have never been satisfactorily traced to climatic influences or differences in food and surroundings. The world has rested content with the explanation that the color of the negro was the result of tropical heat through countless generations, but it is somewhat difficult to reconcile this statement with the facts of history and observation. The effect of color was supposed to be largely dependent on the degree of distance from equatorial regions. This theory is met by the equally difficult fact of the existence of light-shaded men in the interior of Africa, and from that other long and well-known fact that the coppery tinge is common to races in temperate zones. The negro appears to be a distinct type, and cannot be confounded with any of the other tropical races. It may be argued, with some degree of plausibility, that if he is the result of climatic influences, then, by the same influences, other races, similarly circumstanced in regard to heat, should have been similarly formed; but they are wanting in many of his attributes of color, form, etc. The North American Indian indicates by his color his probable Asiatic origin, for there is nothing in climate to cause the tinge, else would two hundred and more years have given some evidence of change in our own race. But if change exist at all, it has been on the side of improvement, and the American of to-day—in the North has less color than the races from which he sprang. Yet the negro of the present is the negro of all history. When Assyria was in its glory he was a factor in its civilization, and lives to-day in its ruined temples. When Egypt was young, Africa was evidently old, and the Nubian of the nineteenth century is the Nubian of a period of which only the records in stone are left. We can recognize this coloring of races from the negro to the pure Caucasian, but we are left stranded on the shoals of inconclusive data, in bays to which no rivers lead, in results which, however closely followed, are traceable to no absolute cause. If climate produced in uncounted ages a negro, it should in similar periods undo its work under more favorable circumstances. The records of observation are too limited to solve this problem. So difficult is it to reconcile facts with the theory of evolution, that men like Agassiz have not been able to accept it, but have clung—perhaps unreasonably—to the old and equally difficult theory of distinct creations. While admitting the force of the argument that no preceptible change has occurred in history, written or unwritten, in the color of man as regards races, we do know that the color deepens by exposure to tropical suns; and this, through successive action of generations,

ought to produce a result as intense as that of the negro. There should be some evidence of value in this respect found in the Spanish races that have peopled the tropical regions of this continent, but, unfortunately, they are of too mixed a character to be worth anything as a basis for inductive reasoning.

Without entering into this line of argument further, it is very clear that the surroundings to which animals and men have been subjected have had much, if not all, to do with the various productions that we witness. Probably no instance on as large a scale in modern times has occurred as the changes that have taken place in our own country. The time is short,—barely more than two centuries,—and yet the American type is as fixed and as marked as any of the older races of the world. It is said, and with truth, that we are a mixed race; but, making due allowance for this, there is a certain undefined and undefinable appearance that marks our race, as it marks all races. The American form is as distinct from the German stock, from which it in the main sprung, as it is possible to imagine. Who can fail to observe the square shoulders and broad hips of the Teuton and not draw comparisons favorable to the sloping shoulders and graceful lines of the form of the American-born? These are marked distinctions and strike the eye at once. They demonstrate what I regard as a fact, that slowly, but surely, we are growing a type of men and women that in time will be a distinct race, grafted on old stocks, but molded by climate, food, natural associations, and the law of harmonious development into a class,—whether superior or inferior, at least widely different from all others.

That this change cannot go on century by century without having its legitimate effect on the teeth as well as other tissues is self-evident. They are apparently an evolution from lower growths. The histological features of the human teeth are but a modification of those of inferior animals, changed by conditions and the uses to which they are to be applied. The importance of the teeth in the study of form has been recognized since the time of Cuvier, who displaced the old mode of study of habits and external surroundings by that of the study of organs, and by this means was able to determine, with probable exactness, the general characteristics of an animal from a single tooth. This was subsequently greatly simplified by Bichat, who regarded the tissues composing organs as of vastly more importance; and it is this latter view that has led up to some of the most important discoveries in natural history, and upon which Agassiz based his celebrated classification by which, as Buckle expresses it,* "fossil

* History of Civilization, p. 643.

ichthyology for the first time assumed a precise and definite shape." The same author further remarks (*loc. cit.*): "Another discovery of which the application is much more extensive, consists of the striking fact that the teeth of each animal have a necessary connection with the entire organization of its frame, so that, within certain limits, we can predict the organization by examining the tooth. This beautiful instance of the regularity of the operations of nature was not known until more than thirty years after the death of Bichat, and it is evidently due to the prosecution of that method which he so sedulously inculcated." While it is possible to build up an extinct animal into form from a single tooth, it is equally possible, in reverse order, to designate approximately, from a given climate, flora, etc., the probable teeth necessary for animal life. The conditions that we know existed in prehistoric ages were adverse to anything but coarse developments. It was impossible for organic life to be molded into the finer forms of subsequent ages. As the atmosphere yielded up its proportion of elements, the flora developed into new and more refined expressions; and as the flora became refined, animal life assumed new and better forms. The laws of development are so clearly marked in the different geologic periods of the world's life, that the intelligent thinker has but to study them to be satisfied that everthing is subject to progressive law, working up from inferior developments. When we adopt the principles enunciated by Bichat, and enter into an examination of the tissues of teeth, we more clearly understand these conditions. The immense molar of the mastodon giganteus clearly indicates the coarseness of vegetable life by the efforts of nature to meet this want, for it is a distinctly-marked tooth, wholly unlike that of its congener that followed it,—the elephant. The large cusps, capped with a thickness of enamel of extraordinary depth, forcibly illustrates the character of food required and the force requisite for its mastication. It is the type of prehistoric immensity, and carries the mind back to a period when the earth was given over to savage forms, and when, if man existed, he too partook of the same degree of coarseness, and the giants of fable may have had a real existence. Reasoning from analogical evidence this must have been the case. Advancing from the mastodon to the elephant, as before observed, the changes are marked. The prominent cusps have given way and the tissues are differently arranged to meet the requirements of mastication. As this refining process has gone on from period to period these coarser forms have either disappeared entirely or have been relegated to those districts of the world's surface that are more nearly allied to the conditions where nature, in the wildness of a prehistoric era, affords them a home and surroundings suitable to build up these

gross forms. Thus, without extending the argument, we may assume that there has been a gradual but certain change, and that that change has been the direct outgrowth of climatic conditions. This must precede all other changes. As the variations take place in the proportions of the elements in the atmosphere, a corresponding change is observed in all forms of food, from the vegetable to the animal, and at last the refining process reaches man, and the higher forms of civilization are but the evidences of this progressive development; for, whether we admit the existence of a soul or not, it is clear that the refining process does not stop with the body. In proportion to its advancement from grosser forms is the mind developed, and it assumes phases impossible under a different and grosser diet. The butcher's dog is a name synonymous with savagery, and the first steps to civilize a nation of savages must be through the stomach. Educate our Indian tribes to the use of cereals as a substitute for wild meat, and then there will be a hope of saving the remnant of aboriginal life.

It is a warmly-cherished belief in the Old World that the nobility are of a different blood from the ordinary run of men; and it is this belief that gives them the preponderance of power they possess. In one sense it is true. Surrounded by all the luxuries of a higher civilization, they have developed—a race within a race—of superior mold to the common people, and had the same exact observance of law in all its requirements been adhered to greater results would have been accomplished. What is true of the nobility is true of all the higher classes throughout the world. It is simply a species of hot-house development of the human body, physical and mental, and may progress with good or ill results in proportion as the development is brought under the control of positive law.

The adaptation of teeth to the peculiar requirements of food is one of the most interesting and instructive facts observed in the study of comparative anatomy. Not only are the forms modified, but the tissues are specially arranged to accomplish desired results, and where extraordinary strength is required, they are subjected to a further modification. From the lowest form to the highest is this law of adaptation invariably observed. We see it beautifully manifest in that member of the sparoid family, the common sheep's-head (*sparus ovis*), with its cutting incisors, so similar to the sheep from which it derives its name, and used for the same purpose,—nipping the grasses from the bottoms in shallow seas; its rounded molars, formed for great strength and adapted for crushing small crustacea; the extraordinary development of enamel, with its interlacing fibers, giving the greatest power of resistance. Then we follow up the various series

through the rodents, with their wonderful, ever-growing incisors, and the effective combination of tissues in the enamel and dentine of varying densities; the remarkable organization of tissues in the ruminant molars; the carnivora, with the series of cutting or tearing teeth; the dog, with his almost human posterior molar that unerringly indicates to the naturalist the possibility of mixed food; and still further on, to the quadrumana, with the almost human series; and finally, our own order, the bimana, with its unbroken series, in which mixed food is the certain indication. Now, if the law of adaptation has effected these changes in the past, it must be conceded that any changes in condition or food would equally produce the same results now or at any future time, or, in other words, a law established remains a law throughout all ages. It is clear, therefore, that if we admit that formation and growth depend on the necessities of the individual or individuals, there is a possibility that the coming ages may witness great changes in the development of tooth-structure, in harmony with the progress made in other portions of the economy. Whatever views may be entertained in regard to the theory of evolution, the assertion cannot be successfully controverted that the teeth of our own class have made most remarkable changes in form if not in structure. From the Australian savage, perhaps the most degraded of his order, with his square jaw, prominent canines, increased size of the series, and an altogether close resemblance to the higher quadrumana, up to the highest civilization, we find that progressive development depends on the refining influence of climate, food, and surroundings. It is doubtless true that if we advance by law we can retrograde by law, or, in other words, if teeth have changed through the developing processes of the ages, it is possible that by a change of conditions they may revert to the original type, for the possibility of advance carries with it the possibility of retreat. This tendency to a retrograde metamorphosis is ever present. It is manifest peculiarly in our own teeth in the three-rooted superior bicuspid, two rooted inferior, and the frequent exhibition of double roots in the six anterior teeth and the occasional increase above normal number in those of the molars. While it is not likely that the law of change will carry, in reverse order, to the origin of our class, it is nevertheless a striking proof of kinship to a lower order.

While not prepared to assert, as has been asserted, that Americans are fast tending to a condition when the *dentes sapentiæ* will become mere rudimentary appendages, it must be acknowledged that there is a change in form greater than in other nations in a very large proportion of our population, and not confined to any special locality. That such a condition exists is very clear, but it is not so clear that it

indicates a permanent change. That there are causes at work to produce temporary deviations from original types is evident, and while a variation may become a fixed form in generations, there is no positive evidence that it is more than an exceptional result of an exceptional cause, and that in due process of time the original type will be resumed. Similar, though not so extensive, variations may be observed in other teeth, notably the lateral. In sections of our country that have been settled for long periods and among classes whose habits of life have been fixed for generations, these abnormal presentations are not so frequent.

The early history of our country is a history of labor; a history of change from the barbaric elements to a measurably perfected civilization. The growth from forest and prairie to cultivated farms and great cities has been accomplished in a comparatively brief period, and at the expense of the physical, to a great extent. Such changes could not have been accomplished without producing extensive atmospheric disturbance, and this, in its turn, acting on the human organism, has tended to temporary disorganization. That this is true can, I think, be clearly demonstrated in all sections of our country settled within a limited period, and the effects have not been wholly outgrown in the more developed regions. If the stigma that Americans have the worst teeth in the world be true, though I do not regard it is a fact, it is evident that as the causes producing anatomic defects are removed there will be a return to original types, and by hereditary laws these will be made permanent. It is a favorite theory of the people of the older settled portions of the world that the American race is fast degenerating. But this theory has no foundation on fact; indeed, statistics clearly demonstrate not only a superior degree of health in all the thoroughly cultivated portions, but also show that longevity is on the side of this country.

While acknowledging the fact that the admixture of races tends to irregularity in the dentures, it can only be regarded as a temporary lesion that will be overcome through the changes before spoken of, in which type-forms are arranged by the inevitable laws of growth. It may require generations to bring about the balance in development, but that it will come is as certain as that natural processes always tend to perfect harmony of structure, and sooner or later accomplish it.

While food is without doubt the most important factor in the changes evident in tooth-structure, it has not, in my judgment, the influence generally ascribed to it. The evidence clearly indicates that the teeth of man developed in tropical climes are equally as perfect in structure and form as those who dwell in Arctic regions and

consume a greater quantity of carbonaceous matter. And this observation holds good throughout all changes of temperature. An extended examination of the skulls of all nations, from the extreme of heat to the extreme of cold, and from the lowest savage to the most cultivated civilized race, leads to the conclusion that the nutrition of these organs proceeds, under all varieties of food, to the same end. The very finest dentures I have ever examined have been those of the South Sea Islanders; and almost equally as good have been developed in the most northerly tribes. I am now considering structure, and not caries. That comes under entirely different laws, and must be separately discussed. I am aware that the examination of dentures long deprived of their life-force is in some degree liable to lead to erroneous conclusions, but after eliminating all causes of error, the fact still remains as stated. If it be conceded that all varieties of climate, food, etc., tend to the same general result, then it becomes a question whether we can materially affect tooth-structure by the presentation of inorganic materials for assimilation. The laws governing nutrition are but little understood, and I am not prepared to advocate or refute the favorite idea of some that the density of structure can be increased by a forced nutrition in the life of an individual. That this can be accomplished through the slow but refining processes of inferior organisms must, I think, be clear. It must be acknowledged that while climate, food, etc., have marked effects on form and structure, they cause no material change in density, except of a temporary character; that as development proceeds in harmonious relationship with the various changes, it follows as a natural result that any localized interference will find an equilibrium as these temporarily destructive forces are eliminated. This applies, however, only to the action of a certain general law, and not to the special destructive effects witnessed in caries. There must be a broad distinction made between caries, the result of imperfect structure, and that occasioned by other causes. It is a comparatively easy thing to map out here a place and there a locality where caries progresses with marked rapidity or with extreme slowness, but if the condition of structure be not regarded as a factor, the observations are valueless, if by them it is intended to prove that the teeth of one section are predisposed to caries and those of the other free from it. When it is asserted that one class is more liable to caries than another, it does not necessarily follow that that class has more imperfectly developed teeth than the other which is less affected. It simply means that the progress of caries is mainly due to causes above and beyond mere structure. Its progress depends, first, on the density of structure; and, secondly and mainly, on a myriad of external and possibly entirely local causes.

The opportunities afforded me for observation in Europe lead to the positive conviction that climate acts only in the mode and to the extent previously stated, and is only one of a legion of influences that operate to weaken structure, and that while a deleterious climate may prove destructive, a good or an equable one is no preservative from the effects of caries.

The general idea, before alluded to, that the teeth of the Americans are especially bad, is only partly true, and is confined to structure. Throughout Europe the ravages of decay are in far greater proportion, and not from any intrinsic defects in the teeth themselves, but from absolute neglect. A superficial observation would at once decide that conditions there were exceptionally bad, leading to weak formations. But this would be very far from the truth. Taking the German teeth as a standard for judgment, I have no hesitation in asserting that the structure, as a rule, is better than ours, but I do not regard the average quality as equal to our kinsmen in England. Opportunities have not been afforded me to judge of other nations to an extent warranting an opinion. While I have formed a favorable judgment of German teeth as to quality, there are large contiguous sections where this opinion could not be sustained,—sections where, if I were to judge from the general appearance and mental characteristics, I should suppose that some of the difficulties attending our own development had been theirs. As an illustration, that portion of East Prussia formerly part of Poland is occupied by a people remarkably diverse in all their characteristics from the Germans. Living in the same degrees of latitude and with a climate not markedly dissimilar from other parts of Prussia, they yet have mental and physical organizations very different. With finely-organized nervous structures one would look for brilliancy of intellect, and this is the rule with the educated classes, but it is accompanied by a weakness of tooth-structure very similar to the worst forms of our American teeth. This opinion coincides with that of intelligent American dentists who have labored among this class for a series of years. A thorough knowledge of the interior life of this subjugated people, present and past, would be necessary to draw any philosophical conclusions. Magitot* acknowledges in his discussion of the marked differences of various parts of French territory in respect to their liability to caries, that the reason for this difference is not very clear. While denying the possibility of inheriting caries, he recognizes the fact that anatomical peculiarities come under this law, and seeks an explanation from this source. After discussing the food and drink question he writes:

* Treatise on Dental Caries. Chandler's translation, p. 79.

"We have already remarked upon the influence of race in the question which occupies us, and it seems evident that we must have recourse to considerations of this nature to explain the various tints the chart * offers us.

"In consulting the documents collected upon the ethnology of France, particularly the remarkable work of M. Broca, we recognize that the best-preserved vestiges of the two principal races that have peopled our soil are represented in our chart by opposite tints. Thus, the Celtic race, included in the region of Brittany, is marked in white; the other white region is still correspondent with an agglomeration of Gallic peoples,—a central Celtic region. On the other hand, if we regard the black track crossing France from the north-east to the south-west, without taking account of some intermediary tints of no importance, we find that this direction is precisely that followed by the Cymric invasion which entered Gaul about the seventh century before our era and left such lasting traces. Now, to the well-defined contrasts separating these two races,—Celtic and Cymric,—we think there should be added the circumstance of numerous cases of caries, through the primitive defects of dental constitution. . . . The constant opposition of tints conducts us to this conclusion: that the population of France is divided, in a general way in regard to dental caries, into two great families,—the Celtic family has small and stocky individuals, with a hardy dentition; the Cymric family has large, blonde individuals, whose dental organization is defective." While I would hesitate to question so high an authority, it would seem as though this statement is based more on theory than actual observation. Mere tables, whether compiled by individual or governments, when they detail simply results, are only of moderate value. It proves nothing that a certain number of individuals lose more teeth than a certain number of others, differently located, or that more teeth of a certain kind are habitually lost than others. It demonstrates nothing to say that more of the wisdom teeth are lost than of the second molars, more of the superior laterals, than the centrals, and more of the bicuspids than either, or that the first molar is the most predisposed tooth to caries of the series. It simply means, with the exception of the latter, that these teeth are more subject to local influences than the others; and in the case of the first molars, it is a question whether these have not more to do with the destruction so common than even defective structure. In this country, where opportunities for observation on various races are more extended than in any other, it has been observed that, even with the exceptional good character of the teeth of the Celtic race, they rapidly succumb to influences found here.

* Chart of the Distribution of Dental Caries in France (*op. cit.*).

Whether these are to be looked for in climate or in food, or whether both combined produce a change in the secretions, is still an open question. The solution of this, it seems to me, must be found in local disturbance that finally ends by the hereditary laws before spoken of, in anatomical defects, which in turn, by the same law, reproduce under better conditions more perfect dentures.

Nations become, through generations, a condensation of the conditions by which they are surrounded; in other words, man is so much atmosphere, so much food, so much association, and, in time, so intimate does this relationship become, that any diminution of these particles is just so much towards starvation. Deprive the body of its accustomed nutrition and just to that degree it withers and fades. We are accustomed to believe that man is the most readily acclimated of all animals. We mean by this, that he can accustom himself to any variations of climate; but, while this is in part true, it is true only as regards atmospheric changes. Those other elements that enter into life are not so readily accommodated, and it requires a long series of years to accomplish it. My experience abroad leads me to the conclusion that every American born has to undergo a process of slow starvation there, and that not because he or she cannot eat the food, but because it fails, measurably, to afford nutrition. While the German will flourish on his brown bread and coffee, the American starves on the best *menu* of the hotels. So universal is this that a comparative state of health can only be maintained by change. My own experience and that of every member of my family was that, whether the food was prepared well or ill, palatable or otherwise, there was always a feeling on rising from the table of a system unsatisfied. A distinguished physician of Leipzig remarked to an American patient, "You Americans cannot live in Germany; you are all starving for something in the air or food not obtainable here." In time, of course, a change is effected, and then the man or woman becomes, to that extent, a German, and loses the pure American type, and this is greatly increased in his children. The proof of this assertion is all around us. A very superficial examination of the children of German parents amply demonstrates it. In many cases the pure German type is lost in one generation. What is true of the German is equally true of all others. Herbert Spencer* remarks that "When a dweller in marshes lives in an atmosphere which is certain death to a stranger; when he sees that the Hindoo can lie down and sleep under a tropical sun whilst his white master, with closed blinds and water-sprinkling punkahs, can hardly get a doze; when he sees that the Greenlander and the Neapolitan subsist comfortably on their re-

* Social Statics.

spective foods,—blubber and macaroni,—but would be made miserable by an interchange of them; when he sees that in other cases there is still this fitness to diet, to climate, and to modes of life; even the most sceptical must admit that some law of adaptation is at work. Nay, indeed, if he interprets facts aright, he will find that the action of such a law is traceable down to the minutest ramifications of individual experience. . . . This universal law of physical modification is the law of mental modification also." An interesting field is open for future observation in regard to the changes in teeth of those who have kept the race pure. There is one that ought to give rich results, but one to which I have had only limited access,—the Jewish stock. Close observation here in different countries would enable us to arrive as near as we will, probably ever be able to do to the proportionable influence on teeth of climate, food, and surrounding associations.

The thoughts I have thrown together lead, perhaps, to no conclusions. In the contracted limits of a paper it is impossible to elaborate them with the clearness desirable, hence I regard them as merely suggestions,—simply a step in the direction of an elucidation of that mysterious process we call nutrition. If civilization be a process of destruction to the dental organs, then it follows that it cannot be limited to these but must embrace the entire organism. But I am not prepared to admit this as a fact, though nations, as individuals, seem to have a limited period for youth, maturity, and old age, before final death. The subjects I have endeavored to treat are as broad as humanity, and enter into the deepest and most sacred relations of life. To us, professionally, belongs one specialty, that of conserving the teeth. This it is our highest duty to know scientifically, and to draw philosophical deductions from facts is our province, and thus, as teachers, perform our part to lead the people on to higher estimates of the duties and responsibilities of our new life, that we may become a distinct people, with the foundations so surely laid, that out of fragmentary nationalities we may become a composite whole, a nation destined and worthy to lead the civilizations of the earth.

1881.

THE regular meeting was held at the office of Dr. Essig, Saturday evening, January 8, 1881. Dr. Daniel Neall, president, in the chair.

The essayist of the evening, H. C. Register, M. D., D. D. S., read a paper, entitled

GRAFTING ARTIFICIAL CROWNS IN LIEU OF PLATES,

of which the following is an abstract:

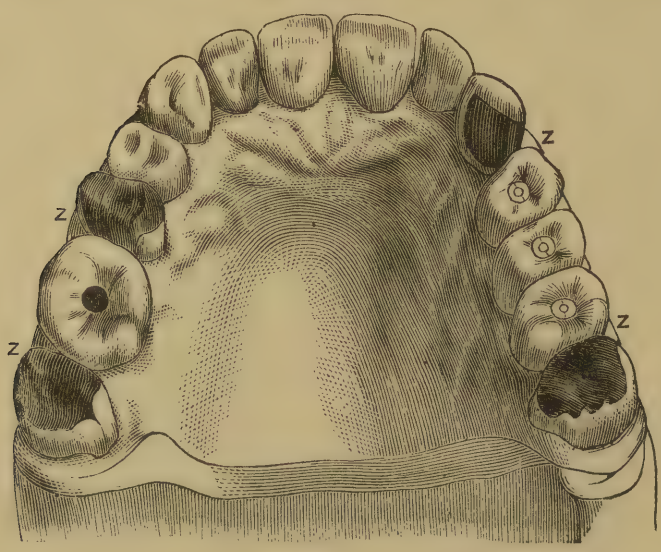
Dr. Register said it was doubtless within the experience of many dentists to have listened to appeals from patients who had suffered, from accident, from caries, or from the incompetency or carelessness of a dental practitioner, the loss of one or more molars, bicuspids, or even the oral teeth, and who desired to have the resulting deformity corrected without the necessity of wearing a plate. Such persons, if males, are not only solicitous about appearances, but want especially something upon which they can depend to masticate without hesitancy and without fear of its dropping from its place. Lady patients, whose pride leads them to place a higher estimate on the esthetics of replacement than on either comfort or utility, or both combined, generally learn to use a partial artificial denture on a plate more or less successfully; but the disability annoys less than does the presence of a foreign body in the mouth, and they soon, therefore, dispense with the incumbrance, wearing it only as a Sunday-dress, or on festive occasions.

FIG. 1.

Dr. Register proposed this evening to give the result of an experience, covering five or six years, of a method of supplying the needs of

a majority of these cases. Let us consider a case such as is presented to you for examination. It is a typical example of those which meet the eye of every practitioner almost daily. The first and second molars are absent, the third molar remains. The gap has somewhat closed, but it is still sufficiently large to render useless for mastication a fine inferior molar. The patient is a gentleman of culture and means, who never objects to prices, but who does strenuously object to wearing a plate. Some months ago Dr. Register performed for him this operation of grafting, converting this solitary molar into an abutment from which to span the chasm. The teeth in the inferior jaw, which, lacking occlusion, had already begun to elongate, now have the necessary pressure supplied by a durable fixture, enabling the patient to masticate his food thoroughly and with comfort. The essayist had termed this operation "grafting,"—using a license which is recognized as allowable in poetry, and which may as well be claimed by art. Grafting, according to Webster, means "to insert, as the shoot or scion of a tree is inserted in another tree, as the stock which

FIG. 2.



is to support it." Of course, the term in this connection is used only in the sense of support, and not of growth. It might be apprehended that a fixture of this nature would so interfere with the natural movements of the teeth as to produce inflammation or death of the pulp, but experience did not justify such a conclusion.

The doctor spoke of having seen, several years ago, two approximal cavities which had been filled with amalgam and bridged across. The operation struck him as being radically wrong in principle, but the gentleman said it gave him no trouble, and he decidedly objected to the making of a separation. It was this little incident which a short

time after led Dr. Register to think that bridging these spaces with permanent fixtures was practicable, giving to such patients a full arch without a plate. The operations are simple, because any practitioner of ordinary ingenuity can perform them; and yet they require the exercise of good judgment and mechanical skill. That they are practicable, the successful use of them by more than a score of the doctor's patients justified him in saying. In a period of six years but one crown has been broken off and one pulp destroyed by thermal influences. The essayist had expected to present to the society a patient upon whom he had performed his largest operation of this kind about a year ago, where seven grafted teeth do all the mastication; but he being out of town, was unable to be present, and inclosed the complimentary letter which the doctor begged to read. He had had numerous expressions of satisfaction from other patients, such as: "I would rather give a hundred dollars for this operation than ten for that abominable plate."

Dr. Register claimed that comfort and usefulness are as much to be considered as appearances, and that our practice should be eclectic. It is a great drawback to an operation that it should be so tedious as to utterly exhaust the nervous force of the patient. He therefore put the use of a good amalgam on the same footing with gold for the entire or partial attachment of these fixtures. In view of his own experience he claimed that the attachment of any number of teeth by this method was good practice. Isolated teeth, when the investing membrane is in good condition, are, in ninety-nine cases in a hundred, sure not to give after-trouble, provided all the conditions of success are carefully met. Dr. Register said that he did not wish to be understood as giving amalgam the preference in these operations. On the contrary, he would, so far as he alone was concerned, prefer gold.

There are two forms of fixtures which can be made either of gold or platinum, or (which he much prefers) of iridinized platinum. If amalgam is used, the latter metal is a necessity, because gold is unreliable when used in connection with amalgam.

Dr. Register then described what he designated as a very simple arrangement of plain plate teeth, backed in the ordinary way, originally used by Dr. Bing, for the attachment of a single tooth, and more recently demonstrated very beautifully by Dr. Webb. The backing can be allowed to extend over and cover the grinding surface. Dr. Webb cuts a groove around the approximal and cutting edges, and fills in with foil by the aid of the mallet, his object being to gain strength. The same result may be reached by the use of pure gold plate, which is easily burnished to place, minus the grooves. A flat-

tened wire of sufficient strength is placed close to the gum, and allowed to extend into the facing teeth, in which cavities have been made for its reception, the wire being bent at right angles with the shaft and the angles imbedded in the teeth. To this wire the artificial teeth, after being nicely articulated and the necks perfectly adapted to the contour of the gum, are soldered. If the pulp be dead, advantage should be taken of that fact, and the wire made to enter the canal as far as possible. When the pulps are living, the angle must be towards the cutting edge, extending back as far as practicable without risking an exposure of them. The form of the cavity should be as near a dovetail as possible, and with good strong walls. The portion of the wire within the cavity should be barbed, and so placed that a packing instrument can readily be made to reach around the entire circumference. The major part of this can be done upon the model, and when there is danger of over-fatiguing the patient, it is best to attach one end of the bar at a sitting, holding the other end temporarily with an oxychloride or oxyphosphate cement. When gold is used exclusively, it is best to complete the operation at one sitting, or at least to finish one filling and the cervical portion of the other, as otherwise subsequent manipulation becomes uncertain. The plan which Dr. Register now invariably adopts is to strike up a rim or saddle of iridinized platinum, or very stiff gold, perfectly adapted to the alveolar ridge, and the teeth fitted to and allowed to extend over and imbed themselves in the gum. (It is best to use zinc dies.) To this saddle attach the bars for entering the natural teeth. On this saddle solder in their proper places as many pivots as are required for the teeth to be grafted. These pivots can be made of three-sided, threaded, or split wire for the attachment of a tooth somewhat similar to the Bonwill or Foster crown—the difference being that the necks on the palatal and buccal surfaces are made much neater and long enough to reach up into the gum and bury themselves, forming a festoon which gives them a natural appearance. The hole in the crown is made square and dovetailed in two directions. The tooth is attached to the saddle with amalgam in the same manner as a Bonwill crown is attached to a natural root; or (which the doctor much prefers) where plastics are used in part, or where gold is used entirely, a square nut is made to run upon a threaded pivot and imbed itself in the artificial crown, and the interstices are filled in with gold, gutta-percha, oxyphosphate of zinc, or a small quantity of

FIG. 3.

alloy. After the graft has been fitted as perfectly as possible upon the articulated model of the immediate parts, the crowns can be removed, and the saddle alone fitted into the cavities which have been prepared, and fastened permanently into place, thus allowing all the room necessary for a perfect manipulation.

If amalgam has been used, either in the canals or in the cavity, a day or two should elapse before filling the body of the tooth with gold and attaching the crowns. When gold is used throughout, the operation may be performed at one sitting, provided the patient has the strength to endure it.

In case of accident to these teeth they are easily replaced, for the saddle forms a permanent base, and the pivot is always ready for the adaptation of a new crown. With the fixture first described an accident becomes a serious matter. The doctor has had, however, but one accident to occur, in which a crown broke off. He replaced it by one such as is shown. The pins are threaded, and are long enough to pass through the old backing. Small nuts, made to run upon them, fasten the tooth to place.

Discussion.

Dr. Webb said, that while he had never inserted two or more together in one space, he believed that as many as eight artificial crowns in place of the incisor and bicuspid teeth could be permanently attached to the cuspids and first molars, provided these teeth are firm in their sockets. He would deem it best, in the performance of such an extensive and difficult operation, to have the pulp-chamber in each cuspid tooth in which to anchor the heavy gold wire (about No. 10, 18-karat) to insure permanency. The wire could be well anchored in the molars without endangering the pulp. The speaker stated, that while the destruction of pulps ought to be the last resort, yet since the pressure of a plate favors absorption of the tissue beneath or near it, thus bringing about loosening of the remaining teeth, and sometimes leading to their loss years before this need occur, and also, since the patient in whose mouth such an operation might be called for, would very likely be of the age when calcification of the tissues is usually complete, then the loss or destruction of the pulp (if the tissue be removed before it is disintegrated) is not so serious a matter as under other circumstances. Indeed, for the maintenance of the normal condition of the remaining teeth, the gums, and alveolar process, the end (if well-attained) would justify the means. Each porcelain crown ought to be soldered to the heavy gold wire extending from tooth to tooth. A groove should be made in both sides of each porcelain crown, into which

gold is built and extended over the palatal portion, restoring the contour—cusps should also be built up where necessary—and thus holding the crown more securely in place. The gold, which should be cohesive, must be made compact as it is put into place, which can be done with the electro-magnetic mallet better than by any other known method. The speaker would have eight such crowns built in place with gold rather than wear a plate, but the whole operation would have to be well-performed by a fine operator or not be done at all. He has now in preparation two crowns—a central and lateral incisor—to be attached to the root of the central incisor and built into the cuspid on the same side of the mouth; the root of the lateral having been lost from fracture. [These crowns, as prepared for the building-on of gold foil, were shown to the members present and the case was fully explained.] He has built-in fourteen crowns in as many cases, and the gums under and about them are in good condition. The operations were so performed that no food can get between the crown and gum. The first of these fourteen crowns was inserted February 12, 1873, and it is now as firm as ever, and those built-in since that time are doing well, though the speaker has re-performed two of the operations, for the reasons that in one case a part of the cutting-edge of the enamel of a lateral incisor, to which one end of the wire was attached, was broken away and the gold was moved a little from its anchorage, owing to improper occlusion of the teeth during a prolonged absence of the patient. The other crown replaced was that of an upper bicuspid, where the patient, by biting a hard chestnut, broke away the porcelain face, leaving the gold attached as firmly to the two adjoining teeth as when built in place about a year before. In re-performing this, as well as the other operation, there was not as much preparation needed, nor was there the pain incident to preparing the cavities as at first, and the gold foil was not only built into the grooves and made compact throughout, but the cusp or cutting-edge of the porcelain portion of the crown was covered with solid gold, and hence was supported and protected from the occlusion of the lower teeth. The foil was so built on and finished before the crown was inserted that the narrow line of gold can scarcely be seen, and it is therefore not conspicuous. In each of these cases the porcelain was so securely fixed in position that it cannot break away. Each patient submitted without complaint to the performance of the operation, and the operator (the speaker) has decided that never again will he build-in another crown without protecting, if not entirely covering, the cutting-edge of each porcelain face, thus insuring still greater permanency of such operations.

Dr. Darby had seen many of these operations of Dr. Webb's, and

could testify to their having been skilfully performed. He differed with Dr. Webb in regard to packing foil in grooves in artificial teeth, thus, as he thought, materially weakening them, and spoke of the difficulty of repairing these cases in case of accidental breakage, and mentioned how he had easily mended one of his that had broken, by getting another tooth of the same mould and same shade, drilling through the backing where the pins were to come, and then, after countersinking well, riveting the new tooth in place by means of a plate-pin punch.

Dr. Essig spoke of a case of seven artificial teeth mounted on a wire and inserted into teeth and roots with gutta-percha and amalgam, done by a foreign dentist. It came into his hands on account of its failure; had only been worn two years, but had been very imperfectly done. He believed in inserting one or two teeth in this way, but did not think it practicable to set more in one space. He spoke in commendation of the operations of this character as performed by Dr. Webb. He considered a neatly-made and well-fitted gold plate much the best where several teeth had to be inserted.

Dr. Bonwill said one of the principal objections to teeth inserted on the Bing plan was the difficulty of repair in case of fracture or accident. He believed rather in attaching crowns to roots in such a way that in case of accident a new one could be placed, and spoke of his well-known method of inserting a barbed wire in the root, leaving the wire long enough to pass through the crown, and then attaching the crown over the wire by means of amalgam. If he mounted on a small metallic base, he would use a combination of platinum and iridium, on account of the greater strength obtained. He also spoke of the adaptation of his crowns (all porcelain) for such operations as those shown by Dr. Register, *vide* his article on "Pivoting" in the August number of Dental Cosmos for 1880, and referred to the necessity for such teeth, whereby replacement could be made on the plate, if necessary, without disturbing the work of anchorage. He also said that where cases required it, bolts, with threads cut thereon, could be anchored in sound or any adjacent teeth, and the crown or crowns placed on with a nut, so that the whole thing could be removed for repairs to plates, artificial teeth, or natural teeth.

Dr. Webb explained more fully some of the details of his general practice of attaching crowns. He further stated that, while Dr. Bing is said to have been the first to insert artificial crowns where a root was missing without a plate or clasp, yet others have made modifications and some improvements in this manner of inserting crowns. Dr. Bing simply backed a porcelain crown with 18-karat gold plate,

and to this soldered a gold wire, each end of which he built with gold into a cavity made or prepared in the palatal portion of the enamel of each of the two teeth adjoining; the wire being thus exposed and liable to retain pieces of food about the parts. It was stated that he also extended a point of gold plate or wire into a cavity in the approximal surface. The speaker not only claims the building of gold foil into a groove made partially or entirely around the sides of the porcelain, and restoring the contour of the palatal portion of the crown, thus devetailing this porcelain in place and making it more secure, and the crown more cleanly, as original with himself; but the building of such a crown into the approximal instead of the palatal surfaces of each of the two adjoining teeth, and having nothing but pure gold exposed, is a different operation. When such operations are well performed they are not only more secure, but present a finer appearance than those done according to Dr. Bing's method.

Dr. Bonwill thought the objection to Dr. Webb's method was the weakening of his artificial crown by packing gold about it, and then the great labor and loss in removal, when made necessary by accident.

Dr. Darby said that the packing of gold in a groove cut in an artificial crown certainly weakened it, and he therefore must object to this portion of Dr. Webb's plan.

Dr. Bonwill wondered how Dr. Webb was sure, after soldering his artificial crowns to wire, that he had not cracked them.

Dr. Webb said there might not be absolute certainty about it, but he took great care in his heating.

Dr. Bonwill said Dr. Webb's plan was essentially the same as that of Dr. Bing, and, all things considered,—time, expense, labor, ease of repair, etc.,—he preferred the Bing method.

Dr. Webb said that for the reasons already given, his method of attaching crowns is not essentially the same as Dr. Bing's, whose plan, while requiring less skill, time, and labor, does not make so fine and permanent an operation as when a crown is prepared and built in place, as practiced and advocated by the speaker. The preparation of the porcelain, so that the gold can be nicely and solidly built into a groove along each side, and carried so far over the cutting-edge as to bind in and protect the crown, strengthens rather than weakens it when the work is properly done or the operation completed. A porcelain crown is made far more secure and the parts more cleanly in this way than by simply backing with gold plate and depending only on the platinum pins for support. The preparation of the crown and building of gold foil is done out of the mouth at whatever time may best suit the operator, but the work requires care and must be

skilfully done. If the whole operation of attaching a crown be well performed, the necessity for repair will so rarely occur that provision need searcely be made for it; but if it be best to do this, the crown devised by Dr. I. F. Wardwell, of New York, is the proper one to insert. His plan consists in so arranging and soldering a thick, rather narrow gold plate to the platinum pins in the porcelain crown and beveling the sides of the plate towards it as to have this plate slide tightly into another gold plate, shaped to receive it. This second gold plate is soldered to the gold wire, which is built into cavities in the adjoining teeth with gold foil, and by inclosing the beveled sides of the plate on the porcelain, "dove-tails" or holds the crown in position. The crown is then pressed into place and made secure by filling-in gold foil near the cutting-edge of the tooth, after the wire with the plate soldered to it is built in place. Should the porcelain break in such a case, another crown can be substituted without removing the wire.

Dr. Essig spoke of the greater strength of platinum and iridium than of platinum alone.

Dr. Tees.—Platinum, with pure gold as a solder, is the proper metal to use for these appliances, and Bonwill's crowns are the proper teeth, provided there is not too close an articulation with the lower teeth. In case of fracture, a new tooth can be supplied without removing the fixture. I do not agree with Dr. Bonwill that amalgam should be used instead of gold in the case presented by Dr. Webb. Amalgam should never be used in the anterior teeth when the pulp has been devitalized.

Dr. Daniel Neall spoke of the different methods of mounting artificial crowns without plates, as described by Drs. Register, Webb, and Bonwill. He thought the objections to the plan proposed by Dr. Register were the probability of food collecting beneath the narrow band to which the crowns were attached, and the possibility of this band bending under the pressure of mastication, especially where the band was long and supported several crowns. In reference to the plan of building-in crowns with gold, he could not believe, for his part, that any operation that took three or four hours to perform, as in the cases done by Dr. Webb, and which then was so liable to accident, upon which the whole appliance would have to be removed and done over at great labor and expense, was the proper one to perform. He did not believe that the results warranted so great an expenditure of time, labor, money, and vital force, on the part of both patient and operator, while there remained other processes simpler and not exposed to this objection.

Dr. Tees.—It is almost impossible to crack a tooth in soldering

ordinary care being taken in heating up the set, if asbestos is used instead of sand,—two parts of plaster and one of asbestos. There are three varieties of asbestos in the market,—a hard, shredded kind, somewhat resembling talc; a soft, feathery kind; and a brown, pulverized. The second variety is used in continuous-gum work; the last is the proper kind for gold and silver work.

The regular meeting was held Saturday evening, February 5th, 1881, at the office of Dr. Pettit, 1624 Chestnut Street, Dr. Daniel Neall in the chair.

Dr. E. R. Pettit exhibited and explained his improvement for the dental engine, which is a very simple device, especially applicable to the S. S. White dental engine, and it can be attached to it in a very few minutes' time. This improvement consists of a hinged joint with a swivel movement, which is inserted between the standard of the dental engine and its attachment to the base, above the driving wheel. By means of this joint—which is simply a friction clutch—the standard may be changed *instantly*, with one hand, to any desired angle, the swivel movement permitting the top of the standard to follow the slightest movement of the handpiece back and forth. As with this movement the rocking motion of the standard is not desirable, he also exhibited a simple arrangement which accompanies the joint, by which the rocking was prevented. He claims that by this simple device the *drag* upon the hand is *entirely avoided*, thus permitting greater delicacy of touch; much greater freedom of movement of the handpiece itself; avoiding the vibration of the flexible arm, and consequent breakage of disks; and also, by means of an extension treadle, or the use of a motor, the dentist can operate equally well on either side of the chair without moving the engine, as the top of the standard is brought directly in front of the patient.

He also exhibited his new device for holding the engine-arm in place when not in use. It consists of a ring of metal clamped to the sleeve above the handpiece and a hook soldered to the standard, about fourteen inches from its top. The ring is to be placed upon the hook when the engine is not in use.

Dr. Pettit also exhibited Griscom's new electro-motor for sewing machines and dental engines. He explained its construction, and demonstrated its many advantages over previous ones in power, simplicity and size, as it weighs but three and one-half pounds. He showed his method of attaching it to the dental engine, and a simple means by which he could change from the motor to the treadle, or *vice versa*,

in half a minute, when his hinged joint is used. The battery is contained in a box about 18x18x12 inches in size, and consists of six cells. There is a simple device by which the zincs are raised from the acid when the motor is not in use, so that there is no loss from local action. By this same arrangement the speed of the sewing machine or dental engine is regulated, and is under perfect control. It is supposed that for dental purposes one charge of this battery will last about six months. As there are no fumes from it, it is kept in the office without danger of injury to instruments, &c.

Dr. J. A. Woodward—The motor, as arranged by Dr. Pettit, will do all that is required, safely and as conveniently as any motor available at present in Philadelphia. For my use a properly constructed foot-engine is preferred. Electrical appliances exact uniform conditions to work efficiently. Their care cannot be given to any but those who understand and have sufficient interest to keep them in proper order. The advantages of the motor would not be sufficient to compensate me for the care it would demand.

Dr. Bonwill thought that the best motor of the day, all things considered, and the proper one for us, was the water motor in some form. He thought our attention should be directed to the perfecting of this class of motors. Electro-motors, he thought, were too intricate and expensive, and liable to get out of order, while the water motor was without valves, simple and easily managed by even the least intelligent.

Dr. E. R. Pettit spoke in favor of electro-motors over steam, water or other motors; that their running cost is but little; they are always ready for use; easily moved from place to place; comparatively noiseless; under perfect control; require less care than any other kind of motor, and when properly made are much less likely to get out of order. It must not be supposed that they are delicate instruments, like the electric mallet, for, he claimed, that there is literally nothing to get out of order, with proper care. They will last until worn out.

Dr. Bonwill looked forward to good results from the "Otto" silent gas engine, and also to a French gas engine, recently illustrated in the *Popular Science Monthly*. Had been interested recently in the "Tyson" motor, but did not believe it suitable for a dental office on account of the smell of steam, hot oil, &c. He called on Dr. Webb to corroborate what he had said in regard to the difficulty of keeping the electric battery in order, and of the few persons who had proven themselves capable of successfully managing one.

Dr. Webb stated, that while few understand and properly operate the electro-magnetic mallet and charge the battery, still, thorough

knowledge of a Bunsen cell is easily acquired, and when each is properly charged, and the four cells are carefully and tightly connected, the battery is always in order till it weakens, and must be recharged. It requires only about fifteen minutes to wash out and charge two of the four cells, alternately, each week, and the battery costs, on the average, about twenty-five cents per week. Because so many practitioners do not attend to or put the battery in order, this does not argue against the instrument, since nearly all the finest operators are successfully and daily using it.

Dr. Kingsbury spoke of his early experiments with electricity in connection with odontalgia and the extraction of teeth by means of the fluid. He regretted the evident tendency to the introduction of machinery into the dental office. He thought the increasing tendency in the direction of more machinery was to be deprecated. He wished to enter his protest against any further extension in this direction, as he believed that too much machinery only tended to alarm our patients, and render the dental office more repulsive to them. The dental engine was a valuable acquisition, he would acknowledge, and in the hands of the careful operator was a benefit, but in the hands of an ignorant or careless person it was capable of doing great harm, as it had done already. He believed we had no use for electricity or steam as a motive power, either for excavating or filling teeth.

Dr. Merriman, of Salem, Mass., being present and called upon, spoke in favor of the electric mallet, and stated that the patient's dread of the dentist to-day was not nearly as great as formerly.

Dr. Kingsbury said that he frequently saw fillings done twenty years ago that were as good as any done by the electric mallet to-day.

Dr Webb felt sure that no fillings had ever been inserted according to the old, or any other methods, where the gold was as uniform in density, or made as compact and as susceptible to a fine finish, and where it was so placed against and over finely prepared edges and frail walls of enamel, so easily, rapidly and perfectly as is done to-day by the best operators with the electro-magnetic mallet. There is no such thing as mere mechanical manipulation; each definite movement of the hand which guides an instrument is preceded by a definite movement of the molecules of living matter in ganglionic elements of the brain.

Dr. James Truman was opposed to the sentiment that would stop all efforts toward progress. He regarded the so-called machines of the day as a great advance over the past; but at the same time he could not appreciate the value of motors in "engine" work. The labor of running this machine was comparatively light, and we needed the intelligence that could only be secured by the operator attending

to it himself. The rapid changes in motion could not well be secured by any motor, however perfect. He was satisfied by experience and experiment that no instrument consolidated gold equally as well as the electric mallet, but owing to difficulties to him insurmountable, its use had been abandoned. It is possible that in its present more perfect condition these objections may have lost their force.

Dr. Bonwill could not sit still and listen to the anathemas of the president and Dr. Kingsbury against the mechanical appliances of the day, without offering his testimony in favor of many of the devices that are now used that ten years ago were scarcely thought of. While he recognized them as great blessings, yet many operators failed to apply them to the full benefit of the patient in the saving to him of money and time. The electric mallet could be made a very great nuisance; yet, when intelligently manipulated, it could be made to work wonders, and be a blessing to patient and operator, although he preferred his mechanical mallet, believing it far superior, and no labor to keep in order or to work it. Were he obliged to desist from the use of these appliances he would give up the practice of dentistry. Instead of driving patients away he believed his practice was not in the least curtailed from persistence in their use. He does not use the mallet as much as formerly, believing gold alloy superior to gold alone, for many of the cases pertaining to the cuspids.

The regular meeting was held at the office of Dr. H. C. Register, 1907 Chestnut St., Saturday evening, April 2nd, 1881. A paper was read upon

THE ESTHETIC IN OPERATIVE DENTISTRY.

BY JAMES TRUMAN, D.D.S.

We have certainly reached a stage in the progress of our specialty when the question should be calmly and rationally considered: What constitutes esthetic dentistry? We have been so occupied in the past forty or more years in building up a profession, that the details have in some measure been lost sight of, and they are only now just beginning to receive the attention which their importance demands. This feeling is manifested in the questioning of old ideas, and a more careful consideration of the new; in a determined seeking for truth regardless of authority,—an iconoclastic disposition which, unless properly directed, may run to serious evil; in a word, the profession in its ideas and practices is fast entering a condition bordering on the

chaotic. It is therefore well to stop to consider whither tends this unsettled condition, and what means can be taken to organize the active thought and direct the practice to a course of procedure worthy an intelligent body of workers. This cannot be accomplished by one man, but must be the work of many. That the present is an important period for active effort must be conceded; for if the disruptive tendencies, now so prevalent, be not properly directed, it is apparent that there must be a serious deterioration in theory and practice as well as in esthetic culture.

The dentist of to-day is the outgrowth of the dental mechanism of the past, whether we view it from the stand-point of the so-called operative or the mechanical branch. The ideas prominently ingrafted on the earlier workers were purely of the latter order. To be a good worker in metals as a base for artificial teeth, or a good filler of cavities, was the sole aim and ambition of the earlier dentist. The difficulties that hedged round both these performances naturally induced a close absorption of all the intellectual powers of the period, and that it was not unworthily bestowed, the skill manifested to-day is the honorable evidence. This constant and earnest effort to do a few things well, while worthy of the highest commendation, has a tendency to force the mental strength into set channels, and to just that extent weakens its power to grasp subjects in their entirety. To illustrate,—the dental mechanic, intent on making an artistic piece of work *out of the mouth*, has failed to cultivate, it may be, the ideal of an artistic structure *in the mouth*, and, while his lines of beauty may be skillfully arranged for the one, they are out of proportion and inappropriate for the other. So the filler, in his anxiety to save teeth, builds his gold until it assumes and exceeds, in his eye, the loveliness of nature. Thus, gradually, but surely, we have developed mechanism in both branches at the expense of the artistic, while the true work should combine all that is possible of both. These thoughts are, doubtless, truisms to all, and will probably find no opponents; but, while the facts are admitted such is the perversity of human nature, that they are rarely acted upon. Thus, while the extreme of effort in the operative has brought our gold-work in the mouth to such a degree of mechanical perfection, that any advance with that metal cannot be looked for or desired, it is evident that this very perfection has generated sentiments of opposition, in both patients and operators, that has resulted in the development of a new school that entirely repudiates this metal. Between these two extremes we have all shades of thought and practice.

It is not the purpose of this brief paper to enter upon the discussion of this subject, but rather to suggest another direction that may

possibly be of value to some who aim to be something more than mere extremists. We are not all molded alike. We cannot all be painters and sculptors; neither are we all so formed by nature that we can work up a beautiful ideal, or, even if capable of so doing, give it practical form.

Dentistry to-day occupies a very similar relation to esthetic culture that our country does to the arts. It has been the constant reproach of the old world that we were a nation of shopkeepers and mechanics, and we have been sneeringly told that high art was an impossibility from such a basis of unrefinement. The true observer of men and nations, and, above all, of the gradations of mental progress, well understands that the higher expressions of intellectual force are but a combination of lower and, it may be, grosser forms. The mechanic at his bench, the house-wife with her needle, are each in their way cultivating form and ideality, and laying the foundations for a higher expression of these same qualities, and rendering it possible for the finest manipulation of art in the future. Thought concentrated in one direction in the parents becomes, by the law of inheritance, the fixed and higher talent in the child, and thus, step by step, and as the result of progressive development, the advances are made and conditions established for the ideal artist. What is true of individuals is true of nations, and it is reasonable to infer that the development of this country must be towards the finest exhibition of artistic excellence the world has ever seen. This is already becoming manifest, and, unless unforeseen drawbacks occur, the prophecy of a Munich professor, made to an artist friend, "that the time would come when Europe would send pupils to America to study art," will have its full realization.

The same law of evolution holds good in our profession; and, while we may not be equal to our idealistic conception, we may at least reach out toward it and endeavor to correct each other, and so hasten a better day. It is with this idea that this paper has been written.

The dentistry of the present is essentially, in many of its manifestations, barbaric. It is the unrefined expression of the mentality of the bench-worker, not yet advanced through the natural siftings to a higher condition, and hence we witness those fearful monstrosities in both sections of our art, but especially in that of the mechanical branch. This latter has been ably illustrated by Dr. W. Warrington Evans, of Washington, D. C., in a series of papers in the *Dental Cosmos*, 1880-81, and I am, therefore, saved reference to that portion of the subject, further than to refer and indorse most heartily his conclusions. The operative section has been allowed to have its own

way, drifting more and more into pure mechanics, and becoming more and more self-asserting, more and more a violation of artistic laws, and more and more depending for its success on the skill of the mechanic rather than the brain of the operator. The point in the history of the profession from which we may date this departure was the introduction of cohesive foil. This, while it marked a great advance, introduced a tendency to exaggerated expressions and exaggerated ideas of the value of gold. If it did not give rise to the now exploded maxim, "The tooth that is worth filling at all is worth filling with gold," it at least enforced it; and he was a bold man who dared to express a contrary opinion. The extreme limit was finally reached, and a natural reaction set in with its equally reprehensible ideas.

That gold can be worked up into forms of beauty, it needs no argument to prove; that it can be made to serve the purposes of preservation and use every day demonstrates; but that it adds anything to beauty, when combined with the natural organs, all who claim any taste must deny. It belongs to the imcompatibles; its strong contrasts of color must ever debar it from the roll of the beautiful in this connection, and yet, just here, in some minds, it has its greatest value. In nature we have the gradations of color peculiarly demonstrated in the teeth, changing from one color at the edge to a darker at the neck, until, through almost impreceptible variations from teeth to gums and from these to lips, we have a perfect harmony of expression. Ruskin says, "No color exists in nature, under ordinary circumstances, without gradation. . . . The preciseness and pleasantness of the color itself depends more on this than on any other of its qualities, for gradation is to color just what curvature is to lines, both being felt to be beautiful by the pure instinct of every human mind, and both considered as types expressing the law of gradual change and progress in the human soul itself."

The building up of a tooth was in former years considered the highest expression of our art. So beautiful was it in the estimation of some, that to make a gold front tooth, and shape it in the form of the original, was regarded as an exquisite piece of dental mechanism, and the operator viewed his skill with the satisfaction of having accomplished a masterpiece. In one sense this was true. It was a masterpiece of pure skill, but at the same time it was direct evidence of skill misapplied in the production of a contribution to a barbaric taste. It had the merit of being useful, while the gold ring in the nose of the savage has not; but both deserve to rank with the productions of an uncultured era. The production of the few teeth of this kind has been followed, through the introduction of machinery and the easier

application of force, by the presentation of many such operations, until we have the mouth in a glitter of disagreeable contrasts that are disgraceful to us as a profession, and are building up in our patients false standards of taste, for which the doubtful advantage of use does not furnish a compensation.

The so-called axiom, that "any tooth, no matter how defective, if it can be saved and made to subserve a useful purpose, is better than a false one," has had largely to do with this. That this is based on incorrect ideas and mere assumption, must be apparent. Even under old modes of insertion of artificial teeth it was never true, and now, with the advances made in this department, it is even less so. It is assuming that artificial teeth are partial failures; that they are, at their best, but imperfect substitutes, while the truth is that, in the large majority of cases, they are not only substitutes, but perform the work so perfectly that the wearers do not appreciate any difference in the ability to masticate food or the correct articulation of sound between these and the natural organs. This matter has received careful consideration from the writer, and it is a positive conviction that the attempt to save a certain class of teeth at the risk of permanent disfigurement of the patient, is a stretch of professional skill wholly unwarranted. That this will be regarded as an extreme statement, and at variance with accepted teaching, I am well aware, but it remains for those who controvert it to demonstrate its incorrectness. I wish, however, to be distintly understood at this point. While condemning the undue exhibition of gold on the anterior teeth, I do not wish to be understood as opposing its free use in posterior teeth, for here use supersedes taste; indeed, that does not enter at all as a question at issue. Neither would I condemn the moderate exhibition of gold on approximal surfaces with labial fractures, but I do condemn that excessive use of this material on the labial surfaces, which carries, by its incongruity, a sense of disgust to every beholder. I need allude here only to the minor manifestation so frequent of this sin against taste in the filling, oftentimes large, of all the anterior teeth at the upper labial thirds with gold. The expression that this gives to an otherwise beautiful face need only be seen to be fully appreciated. Attempts have been made in this form of caries to insert a section of porcelain or of tooth-bone, but this, while an effort in the right direction, has been only partially successful, and it is by no means the general practice. Gold is the one material we have for this operation, and any departure from its use is regarded as worthy of severe condemnation. It is true we have no material that equals it for tooth preservation, but it is a question whether a poorer one and one nearer the color of the tooth would not be better than a piece of work which

is a constant monument to our ignorance of the law of contrasts. Yet, while this is asserted in regard to these peculiar and most annoying cavities, even here gold may have a very proper place, provided an intelligent consideration of the probable issue of such an operation be carefully made,—such as length of lips, facial muscular movements in talking, laughing, etc., the sex of the individual, and the extent of the lesion.

It is not to gold, primarily, that objection is made, but to its use in inappropriate places. As a material for filling, it will always, probably, retain a royal position; properly used, it is the best material for a very large class of cavities; but to assert that its proper place is to restore lost teeth in the anterior parts of the mouth, or to universally repair lost sections, is to claim that which no refined intelligence can for a moment tolerate. The influence of such work is demoralizing on both operator and patient. It is an ever-present sign of partial culture, and partial culture in art mechanism, as in everything else, is just so far an evidence of inefficiency, if indeed, it is not positive evidence of it. The true dentist is something more than can be made by a mallet and a sheet of metal. He is a combination of varied experiences of the past and present. He aims to grasp reasons and to search into the philosophy of things. His diagnoses and prognoses are carefully made, and his course is guided by his conclusions. He regards his material, whatever it may be, simply as a tool, and, as he cannot effect the best results with one form of instrument, he must make use of many. He believes that the intelligent adaptation of means to ends is better than a blind following that leads only to inconsequential results. He refuses to replace natures' destructions by a disfigurement of nature; and, above all, he aims to combine the practical with the esthetic, that use and beauty may go hand in hand, and through his work his profession may receive a new impetus toward a higher standard of excellence.

Discussion.

Dr. Darby thought there were many truths in the paper. He thought, with the essayist, that large operations in gold in the front teeth indicated lack of taste on the part of the operator. He believed the highest art consisted in concealing art. As we had substitutes for such cases, he believed they should be judiciously used. He would rather have a good pivot tooth nicely mounted, in the front part of his mouth, than a natural tooth, one-half of which had been restored in gold. In the setting of pivot teeth with metallic pivots, he had discarded the use of gutta-percha and now used phosphate of zinc.

Dr. Essig would rather have a pivot tooth or an artificial one on a plate, then a tooth restored with gold in his mouth. He believed in

concealing gold wherever possible. He described the method of inserting natural enamel in exposed cavities, setting it with oxy-chloride and afterward filling around the joint with gold foil. He had an operation of this kind now in his mouth, performed by Dr. Jack twenty-five years ago.

Dr. E. H. Neall.—No one objected to a considerable display of gold, either in large labial fillings or in restoring corners of broken teeth, more than he did; at the same time he believed that in certain cases, and especially for young people, a small line of gold showing in one or two of the anterior teeth along their mesial surfaces rather enhanced the beauty of the mouth. Besides being beautiful, it argued care and attention on the part of the person. To him it was an inspiration to see such work, not only because it had taken skill and judgment to perform, but also because of its good taste. To fill such cavities so that the gold will not show, as recommended by some, would necessitate the destruction of the original contour of the tooth and catch the eye as a blemish, whereas the line of gold, would, by its very nature, disarm criticism.

Dr. Register said that when he attended college it was taught and considered the correct thing to have as much gold show as possible; whereas now, he thought the tendency on the part of the profession, as well as the patient, was to have as little in sight as possible. He had lately seen some teeth filled by college students, where much tooth-structure had been cut away and its place supplied with gold, where the original structure might have been preserved. He strongly condemned such practice.

Dr. Tees differed with some of the other speakers, in that he taught his patients that the showing of gold in the mouth was a sign of care taken, and an indication of refinement. He favored artificial crowns in front teeth where they had been broken and the pulp destroyed, and believed that the "Bonwill" crown was the crown of the future. In setting artificial crowns with metallic pivots, he preferred gutta-percha to any of the zinc preparations.

Dr. Darby thought a crown cut off, when broken, and replaced with an artificial one the safest, best, and most durable operation for such cases.

Dr. E. R. Pettit had such a horror of wearing a plate that he would rather have his front teeth built up with gold, if they needed it, than wear an artificial substitute.

Dr. Essig alluded to the fact that certain men were endeavoring to increase the use of plastic fillings, especially amalgam, and had gone so far as to practice the filling of the front teeth with this material. He felt that the influence of such teaching must necessarily be bad upon the young men entering the profession.

Dr. James Truman said that extremes beget extremes. The natural result of the practice and teaching of men who confine their operations to the use of gold, was to create an opposition party who would not use it at all, but would go to the other extreme and use plastics only. He thought both were wrong, and that a certain conservatism should be both taught and practiced. He was convinced from what he saw and heard during his residence abroad, that the teachings of the "New Departurists" had done great harm there, and he had no doubt an equally bad effect would be felt here.

Dr. Guilford said that he could never identify himself with either party of extremists, for he had always been conservative in his feelings. At the same time, he was willing to believe that both parties would accomplish considerable good in their respective ways; the one by inviting to greater care and skill in the use of gold, and the other by leading to improvement in the preparation and manipulation of the various plastics.

Dr. E. R. Pettit favored the use of plastics in very many cases, and said that if we were paid more, we could afford to use gold more.

Dr. James Truman thought that in cavities in the upper third of the labial surfaces of superior incisors, he would prefer phosphate of zinc to gold, on account of harmony of color, even if he had to renew the operations occasionally.

Dr. Dixon generally preferred gold in such cases, as in others of like importance, for the reason that he wished to make each operation as perfect and enduring as possible.

Dr. Truman spoke of the use of tin foil at the neck, with the rest of the filling of gold in approximal cavities in the bicuspids and molars. He also described the plan of using tin and gold foil rolled together, as originally practiced by Dr. Abbot, of Berlin. He said the latter filling, although it became discolored, also grew very hard through some chemical change, and its tooth-preserving qualities were quite remarkable.

Dr. Register described the plan of his brother of coating cavities, after their preparation, with liquid gutta-percha, and then filling with amalgam. The expansion of the amalgam in setting simply made a better joint by compressing the gutta-percha against the walls.

The regular meeting was held Saturday evening, May 7, 1881, at the office of Dr. Bonwill, 1719 Locust Street. A paper was read, entitled

THE SALVATION OF THE HUMAN TEETH—HOW SHALL IT BE DONE?

Adaptability vs. Compatibility—Successes and Failures.

BY W. G. A. BONWILL, D. D. S.

MR. PRESIDENT—More than a year ago, I was asked by a member of our executive committee, to prepare and read a paper before this society, and he volunteered to suggest it should be on "Dental Appliances."

In my effort to-night I shall aim not to abuse any one more than myself, but to hold all responsible for much of the short-coming of "Latter Day" Dentistry.

I must apologize for the length of this article. The subject is one of great scope. I ask your attention that you may comprehend me and have no excuse for wandering from the points at issue; and that you will, without reserve, differ with me in every particular, where my views do not agree with your experience, practice and observation. Upon some points I may arraign the society or its individual members, and request a direct reply and proof. I may call upon those who have had patients from my hands who have experienced any of my special modes of practice, to state their idea of the causes and all particulars of failures, that I may defend myself against the charges laid at my door of being guilty of a style of practice "very reprehensible and monstrous."

No man should be condemned in unreserved terms for any one system of practice, without his general practice be weighed and all the circumstances surrounding each operation. It does very well to abuse some practitioners who have no qualifications whatever. There are certain marks or footsteps which tell whether a man is entitled to recognition. I think if we would take the trouble to know each other better we would find that none of us are so immaculate but that fully as much of the abuse we heap on others for eccentricity and failures, might be levelled at our own heads.

Principally, what I shall say will be from my own modes of practice, its failures and successes, and that of others, as it has fallen under my

observation, and what I now believe and endeavor to practice, as the best for the salvation of the greatest number of teeth; and it will be couched "*in tones of love to others failing as my own;*" and I ask of you from this hour, when you have found the practice of any of your *fellows* not up to the standard as raised by yourselves, to compare notes with the one who had preceded you in the case at issue, and a better feeling will grow out of it, and a more uniform system will be the result; and we will find that there will be a growth in gentlemen which it is well to cultivate, which jealousy and bickerings alone will not promote. It is no *sin* to "*lose* a patient." We all have to submit to it from various causes. The worst thing about it is to have them leap from the "frying pan into the fire;" to go to inferiors rather than equals. We should be on such familiar terms among our society members that we could freely speak to each other of these cases and the peculiarities, and as to what should have been done; and, when done in proper spirit, would add amazingly to our estimation of each other. We need a confessional, and not so much of this "mutual admiration," which is sickening and unprofitable.

Let us tell how many gold, amalgam, gutta percha or zinc filling we have had to renew in our own practice; or, how many crowns lost after repeated fillings, and artificial crowns placed in by pivoting; or, how many teeth on plates when we could no longer save by our art. While you are thus confessing your inability to preserve the natural organ, don't fail to stoop to take advice from your peers, in practice of specialties, whose experience may be more extensive in that line; and go a step further, open your doors to ultra radicals, so that they be gentlemen, and show that you are willing to face the light from any source, even at the risk of the heat generated being so intense as to possibly consume many of the old forms of practice.

The last decade has been one of such momentous changes we scarcely know how to shape our future practice. What has been done in this short time is bewildering. That we should remodel it or fail, as in the past, you must admit, and look around for evidence whereby we can establish a system of practice which will the more positively assure the greater or more complete salvation of the human teeth.

It is the grand creed of the American people to have extremes meet, and, by agitation and revolutionary measures, consume the old, that a Phœnix may arise purified; and only satisfied with this until necessity again calls for another step forward.

I know you are conscious that the present state of practice calls for ultra measures of reform, and you cannot afford to longer delay.

"The little learning" of the profession has been a "dangerous thing," and the herculean efforts of our infancy has hurled us into

manhood unprepared for the abstract work ahead, and with sufficient knowledge only to see our weakness and inability.

It is alarming to the true lover of humanity and of our profession to witness failure upon failure thus far to stop the ravages of decay. It is creating such consternation in our ranks that many men are asking for "more light." In this crisis where shall we look for succor?

Is there any practice upon which we can rely, whether it be of one alone or a combination of the many? Is there any departure from the old system worthy of adoption? How may we practice in the future as to flee from the wrath to come that should be poured upon our *deserving* heads, unless we meet the urgent necessity?

Certainly there should be, by this time, sufficient experience in failures and successes to enable us to fix upon a creed which the best men can agree upon as sound, and so simple that even the poorest and most illiterate of our calling need not err.

For this noble purpose we are again assembled, and, as a feeble instrument, I am here to compare notes that we may strive to reach a higher eminence upon which to plant our artillery, where it may be impregnable. So far as my own individual ultra systems are concerned, I feel sure they have not grown out of any selfish spirit or expectation of pecuniary gain, as has been intimated; such a spirit does not work by fomenting discussion and investigation; selfishness fears the light.

Then, without presuming upon too much, I ask you to set aside for the moment your favoritism for old practices or prejudices against the new. If I am wrong in my conclusions as to what should constitute the best methods of practice, then let me hear from you without any duplicity, or in terms not to be misunderstood. Let us have a fair and square combat, and come to some conclusion as to the practice to pursue in the future.

We must learn to trust our own senses; and, as we find we fail in theory and practice, let us acknowledge it; and if *we* cannot substitute for ourselves a better course, then adopt such as a responsible practitioner shall give us, if it promises any reasonable hope of better results.

If we are determined to practice dentistry as a trade, then there is no hope. It is only as a profession we should lend our talents to curtail the miseries of the race by giving them such dental organs as will insure better physical organizations. This need not prevent us from charging for time and talent for anticipating trouble, rather than allow the shores to be strewn with hopeless wrecks. Shall we be equal to the emergency, and to-day pledge ourselves to this holy war and take hold of any plan, come from whence it may?

We all feel, I think, that the hour has come when we should be able to shape our practice with almost mathematical precision; and we can approach it if we will but open our eyes to the facts surrounding us.

While I would not disparage the growing necessity for a higher medical knowledge, yet I would not underestimate the *greater* need for the education of future dentists, in the highest mechanical sense, as experts; not in theory, but the hands and eyes should be developed to the keenest perception of what to do and how to do it. If I had to give up either, I would cling to the mechanics of my nature and attend the best schools where my hands could be taught to do not only what others had demonstrated, but what my own brain had conceived. Without this, all our boasted medico-dental education is in vain, except in treating the diseases of the head and face. Unless this branch is more zealously cultivated and elevated, dentistry will continue to be a failure and will never fulfil its high mission. It must be made up of men who are intended by nature for it; who have a holy inspiration; and not of those who were intended for merchants, farmers, bankers and smiths. When the schools shall demand of their matriculants a preliminary examination as artisans, not in theory, but in actual demonstration, that they are capable of performing, with credit, some mechanical achievement, then a medical training will come in very well; but not without the former is first well engrafted.

Now that I am about to enter upon my plan of practice, I hesitate at the responsibility. To ask you to do as I do, is assuming a great deal, and I will be held accountable.

When I look back at my commencement and reflect that my early practice was founded upon what the older men in authority had published and taught, and how I feared to do other than they demanded, I shudder at the many teeth I extracted I know might have been saved, with even the amalgam of that day. And I tremble at the advice *now* given by the authorities that *gold* only should be used as a permanent filling. Young men know no better, but the older ones do. God forgive them, for I cannot. While I do not belong to the disciples of the new departure, *so far as their theory is concerned*, I stand side by side with any one *who can save teeth with plastic materials*, if they cannot use gold where it is indicated. Better do this than persist with gold indiscriminately, as the bulk of operators do, from the highest to the lowest, and lose teeth and all rather than stoop to conquer with *any article* that is *not gold*. The public are demoralized on the subject of *gold*. "Are you not going to fill my teeth with gold?" says nearly every new customer; "Dr. ——— would not think of using anything else." A city operator must have more than the usual quota of courage to stand up before the societies and state "he has been using *amal-*

gam more freely of late." For the first eight years of my practice I would not touch it, because Doctors Elisha Townsend and J. D. White passed their anathemas upon everything but gold and tin. I worked myself nearly to death with tin to find it preserves from caries but not from attrition. Since 1862, I have been feeling my way, and while I think I have reared many beautiful and substantial monuments of gold, and have perfected machinery with which to do it, yet I consume more amalgam than ever before.

A gold filling *properly* impacted, with cavity judiciously prepared and the walls of the same so shaped as to forbid future decay, *will save*, irrespective of the frailty of their bony structure? But as thousands of teeth *cannot be so prepared*, both of strong and frail organizations, and the circumstances *cannot* be controlled, we should resort to something that will enable us the more surely to meet the issue.

To enumerate the many cases of peculiar character that forbid the use of gold, would be too great a task in this article. Physical impossibilities lie in the way of every undertaking; and it is for the successful engineer, who is well acquainted with his material, and their relative strength and *adaptability* for his purposes, to so use each and all, that his design will be consummated, and not in the future wear, prove to be a failure. There is a fitness in every known material that experience has proven to be specially adapted for a given work, and when this general law is recognized by us in our calling and we become first-class engineers, then will we the better see where we can adapt our materials to the work to be done, and we can be the more certain of success, for it is founded on the logic of mechanics and physical law.

Where is the dentist that first lays out his design and orders materials best adapted for specific portions of it?

As well say everything should be made of iron or steel or wood alone as that every tooth should be filled with gold, as say some; or, as *equally ridiculous* by the other side, with amalgam or some one of the plastic fillings.

It is not *necessary* to found a *creed or departure* on a law of *incompatability* to tooth substance. We need not look so far into the unknown and unknowable. We poor, short-sighted creatures must have the tangible; not a hypothesis on a *supposed theory*. Any one with half an eye can see just where the incompatibility is; not between gold and dentos, but between dentos and untutored and unskilled brain and hands to *carry out the law of adaptability*—the correlation of forces involved, if you will allow me the analogy.

One skilled in the use of the mallets, with the rubber-dam and a substantial starting point, with ever so frail walls, can perfectly impact and complete the work in gold filling, *provided the surroundings are*

there. But allow *one little vacuum* between the tooth substance and filling, and a *capillary tube* will be formed that will suck up the *fermentable material;* the *acid generated* will act on the tooth substance, whether it be filled with gold, amalgam, oxyphosphate or gutta percha. A thousand capillary tubes making porosity in the gold or amalgam, will not do it; but if there is one, however small, between dentos and filling, destruction is sure. How long would the approximal surface of any bicuspid or molar remain sound if the opposite surface were another perfect tooth, but so placed that a large amount of their surfaces are nearly in contact; and the walls forming a capillary tube which carries the fermentable foods up with positive force to just beneath the actual point of contact, and where it is impossible for the oral fluids to circulate at that point where the capillary tube is finest? (See Fig. 1.) As certain as death, decay would commence if the decomposed food remained. If it is *incompatibility,* why is it that these perfect teeth, when dentos is only in contact with dentos, go on to certain destruction? Would it mend the matter in the least if we were to take away one dentos and substitute gold, with the approximal wall of exactly the same contour, forming the same powerful capillary tube? Or let it be amalgam or oxyphosphate or gutta percha, under precisely similar relations, and then what would become of dentos with these more compatible substances? Would decay be arrested, even if filled by an immaculate personage, such as Michael Angelo or Raphael, or an angel, while this *physical* law had been disobeyed? No, my friends, it is not *chemical incompatibility,* but *physical adaptability* of means to ends! This ignored, and failure will come. Go further, and place an *artificial crown* of incorruptible porcelain that *has no galvanic relation* with dentos under the most positive or negative circumstances, and let it be crowded against the approximal wall of a perfect tooth, so as to form the exact relation as did the natural tooth, or gold, amalgam or any of the other foreign materials, and then what? Will decay go on upon the dentos in contact with the compatible porcelain? There will be no difference. Do what you may in substituting the most compatible body just fallen from the stars, and if that *capillary tube* is formed, farewell to dentos. We will go yet another step and take the anterior approximal of a first molar and a posterior of the second bicuspid which have already commenced to decay. Each must be filled. (See Fig. 2.) Amalgam is selected as the most compatible and durable for the position. The approximal surfaces, when filled, are to be *self-cleansers*—Arthur plan—with the V opening or division running down to the cervical margin in the most beautiful

Fig. 1.

Fig. 2.

manner imaginable, the lines terminating at the cervix in a fine point; forming another capillary tube at the weaker end of dentos, instead of at the grinding surface (as in Fig. 1), where the fermentable material is drawn by capillary force, and the food is wedged and crowded down until the space once occupied by the almost invulnerable gum at the cervix is forced away, and a pocket or capillary tube is formed from the gum to the shoulder (Fig. 3), where the fillings come into direct contact, and just where the joint is made with tooth and filling. Suppose you that any material, however compatible, with all these physical disadvantages surrounding it, would preserve dentos? Make the same cavities contour with any one of the compatibles (as in Fig. 4), and permit the cervical buccal and lingual surfaces of dentos to so closely approach dentos, near where the margin is between filling and dentos, close enough to hold the decomposing food in constant contact, and no chance allowed for the oral fluids to circulate or agitate over the surface of dentos, and how long, with the most compact of fillings, from the finest dental jewelry establishment, or from one of our plastic institutions, would dentos remain free from caries?

Fig. 3.

Fig. 4.

If it is compatibility, and we can throw in these materials *ad libitum* and without any other law to control us than merely *cleansing* the cavity of decay; without any care to be taken of how approximal surfaces are to be prepared and left; without any fine finish to be placed on fillings or any of that nice manipulation spent on gold; then, it would be *glorious* to recognize this law, and we could look soon for the millennium.

I cannot see it! But I can see that *adaptability*, and not *compatibility*, is the *positive law* which bids us on to a higher state of perfection. While I differ widely with my friend who cries *incompatibility* in his theory, yet I am with him heartily in his effort at saving wrecks of teeth that but few will attempt. Stranded teeth given to the wreckers he delights to take, and does save by *not using gold*, though not in the most æsthetic manner. Whoever will forsake the indiscriminate use of gold and determine to *save teeth* on the principle of adaptability of material according to the skill of the operator, will do the same wise thing as is being done by the opposers of gold *in toto*, and be enabled to give a much more artistic show for the materials used. While I cannot adopt the incompatible theory, I do say God-speed

to any man who is able to save human teeth satisfactorily to his patients, let his creed be ever so incompitible with known physical law.

Salvation of the human teeth is the *creed* and *watch-word*, and we are, many of us no doubt, doing the same thing from apparently antipodal standpoints. Let us raise a flag-staff and rally around a banner by common consent, with such an emblem as heads my paper, with all due charity for every new idea spread before us. In adopting a code of action it is well it should be one which appeals to the common sense and known laws of the universe of forces.

The nearer we can make men understand cause and effect, reason will come into action on all occasions, and better results will follow. Let us proclaim whatever theory we may, there are hundreds in practice who will not grant it, because the majority are not educated in common physics, let alone the chemistry of the elements composing all nature. It will be in vain to appeal to such. Nothing short of demonstration in every little detail and showing them the results of practice, through many years, will reach them.

Men will not believe what others say. The most minute description in print will be read and passed by. If a committee of one or more could be appointed by every State Society to visit the most advanced operators and stand by their sides at the chair and see, not one class of work, but all grades, and how everything is done for the various conflicting cases that daily present themselves, an immense stride would be made, and we would the better appreciate each others' efforts. The invitation to such men, with some inducements to leave home to appear before societies, would probably reach further. The former plan, however, would be more compatible with the feelings of such radicals, as they would rather be found at home, where everything works more harmoniously.

In my talk with you to-night I shall prefer to take the obverse side of the case and speak of my failures rather than successes, for the latter will be evident when the former are properly shown. I do not feel humiliated in confessing my faults. Failures from omission and commission will come; but it is for us to make them less frequent. It is generally the case that just as we reach where we feel our lives will be more methodically spent, we are ready for the grave. It will be impossible for me to enter into my mode of practice in every special case, in a single chapter. I shall attempt to establish principles of action and apply them to a number of cases, with a few simple demonstrations illustrative of each, from which you can easily see whether there is any reason in my vandalism and extreme views.

Whoever read carefully my article on "Anticipation of Caries," in the *Cosmos* of August, 1879, and will follow me in this article, will

perceive that I hold to the belief that decay of the human teeth is due primarily to their relative juxtaposition of approximal surfaces, their sides forming, by their contact, capillary tubes. That this powerful capillary force draws the fine starchy particles of food, as well as saccharine matter, up and up until it reaches that part of tube nearest the point of contact. This tube is acting on all sides—buccal and lingual and next the cervix—except on the grinding surface, where the teeth approximate. That the tube ends where the teeth are in actual contact, and at this point decay never commences, as the space is already pre-occupied by two points in such close union as to be practically one tooth.

That the point of contact is never the first to succumb to the action of decomposed food. That decay progresses toward the cervix, and the grinding approximal surface is the last to give way; and this is mostly from pressure exerted upon the wall of undermined enamel, or where the prop of dentine has been taken away.

That chemical action by acetous fermentation, due to an excess of starch or sugar in our food, is set up just where the finest portion of the capillary tube reaches, and, as it must remain, there is no chance for interchange of particles by the oral fluids.

That in the majority of cases of the present generation, disintegration of enamel commences *immediately* after the teeth are in a fixed position, when the capillary tube is rigidly formed, and it goes on with unremitting energy until complete annihilation of its structure results.

That the teeth of civilized people will, almost without any exception, yield to this physical condition, so long as the elements of fermentation are placed in the mouth, no matter how much floss silk is used; this only deferring the hour of complete overthrow.

That galvanic action is not necessary as a factor in bringing about this purely chemical result of the action of an acid on lime-salt when in contact with it.

That this same law holds good after decay has taken place, and gold, amalgam, tin or any other compatible or incompatible substance has been substituted, if that material is so shaped on its approximal surface as to form a capillary tube, provided dentos makes one wall of the tube, decay will revel just as well and surely.

That the law of incompatibility with dentos has nothing whatever to do with this purely physical change, and that galvanic action is out of the problem.

That if we would save tooth structure it can only be done by immediate action after the teeth are in permanent position, in destroying this capillary force, by giving such shape to the mature organs as to give a chance for the free circulation of the oral fluids.

That if we will not act on this principle and save the teeth by true "anticipation," but permit decay to take place on the approximal walls, it should be checked by filling with that substance which can best be placed in the cavity to prevent any leakage at all points; and their approximal walls should be cut so as to leave one good shoulder at the buccal grinding surface (see Fig. 5), with no tooth structure touching at the cervix. In short teeth, where they touch entirely to the cervix, the opening may be made self-cleansing with parallel walls and nearly square shoulder (see Fig. 6)—not a V, provided the injury has not extended to the cervix. If so, then another course must be adopted. If caries has not been checked until the larger portion of the approximal surfaces are gone, then the self-cleansing principle will not hold good. Nothing will preserve such unless the teeth are widely separated to the gum on the approximal sides by a disk; and then still further separated by cotton, until the walls are so far apart at every point that when the filling is made contour the buccal and lingual walls will be so far removed from the opposite tooth, that no food can accumulate from capillary force. (See Fig. 7.)

Fig. 5.

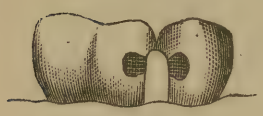


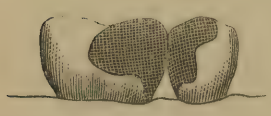
Fig. 6.

That contour fillings should, in all cases where the opposite surface is sound dentos, be so pointed where it touches dentos, that the capillary tube is not formed. (See Fig. 8.) If the contour is made full to imitate nature, and there is no chance for circulation and self-cleansing, then decay will proceed as soon and as fast on that sound surface touched by the contour filling, as if nothing but dentos touched it, let the filling be ever so compatible.

Fig. 7.

That if the point of union,—(see Fig. 7), on the buccal and lingual sides at the cervix—of dentos with the filling be not removed far from the centre of the tooth's axis, where there is least circulation, and the filling carried as far over on those surfaces as will insure nothing but the contact of the fillings alone to form the capillary tube, then decay will surely begin just where the tooth substance comes close to any opposing surface (as in Fig. 4), so as to form a capillary tube; no matter if the joint is absolutely tight, and the filling is of the most compatible material. (*See Fig. 4.*)

Fig. 8.



That no filling, on the approximal walls of the biscus-

Fig. 4.

pids and molars of either jaw can be made properly contour unless carried over upon the grinding surface; by which means all dentos is removed so far away from actual contact as to prevent the formation of the capillary tube.

That unless decay on the approximal walls is attacked soon after its initiation, very few of such surfaces can be successfully and permanently preserved by filling, without cutting out the whole fissure in the crown and contouring.

I think you will not mistake my language nor the principles which now guide me in every operation upon the human teeth for their preservation by mechanical and physical means.

Capillary action now and all the time until I can see and know better. Adaptability of materials and not incompatibility. Chemical and not galvanic action.

That immediate action is demanded and patients examined as early as the second year.

Self-cleansing surfaces being the rule when I began, in 1854, there was no other alternative. A cavity could not be approached except by file or chisel, and cutting away all the natural support at the grinding surface, and transferring the point of contact to the cervix. When there was slight decay not involving cervical margins, and the surfaces were left parallel—not double V—and with a nearly square shoulder at the cervix, with ample room for the cut and filled surfaces to be kept clean by attention and the flow of oral fluids, and the shoulder at cervix was of *absolutely sound structure*, and nearly down to the festooned edge of the gum, when I had no failures of importance, whether I had filled with compatibles or otherwise, if there were no capillary tubes—leaks—left between dentos and filling, and no decay at the shoulder.

But if I wanted to be too nice and allow myself to make one of Hogarth lines of beauty, (Fig. 2), after the teaching of that admirable gold impacter, Dr. Elisha Townsend, and run the knife-edge file so as to make the filed approximal surfaces come together at the cervix in an undiscoverable line, without any square or open-mouthed shoulder, then I invariably failed; for caries would again be set up at the point of union at the cervix, just as it did when the same lines were formed at the opposite end, terminating near or under the grinding or cutting surface. The capillary tube was simply reversed and to

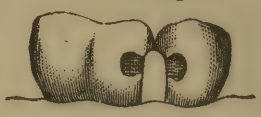
Fig. 2.

Fig. 6.

a weaker point. It will be found that the ideal self-cleansing surfaces owed their success to the *bold, wide-mouthed* division, with absolutely sound, square shoulders, even with poor, soft fillings of gold, tin and amalgam. Such can be done to-day with the poorest class of teeth, when you act before caries has at all involved the cervical border. (Fig. 6.)

In the cases with narrow necks and wide crowns when opened from the palatal side only, and no contact between the teeth, except at the bucco-grinding surface, and that confined to the nearest point and the filling not allowed to come close to this point of contact to form a tube near to where comes the joint between filling and dentos, such cases are safe even with the most incompatible substance. (See Fig. 5). I failed in nearly all cases where decay had passed this primary stage first spoken of, and involved the cervix and bucco grinding point of contact when self-cleansing surfaces were attempted. Just where the joint made by the filling and dentos came, if near to where the capillary tube, at its finest calibre, was formed by those separated teeth coming together, there was the beginning of failure. (Fig. 9.)

Fig. 5.



But on the other hand if I took these same second-class cases and separated entirely through to the gums, cutting off all sharp and disintegrated approximal surfaces, and if not then far enough apart, used cotton saturated in sandarac varnish, (I frequently stuff in the cheap pink gutta percha without making any division between the teeth at the time, and allow it to remain for weeks, which gradually separates by the masticating upon it, and at the same time the dentine becomes less sensitive;) and when dentos is widely away, and the buccal and lingual or palatal walls of the cavity are carried far over on to face of tooth, and, with the line of filling at cervix cut under the edge of gum (see Fig. 8), then fill with compatibles or incompatibles, if the same are made contour and dove-tailed into the fissures on the grinding surface, success will crown nearly every effort. Notwithstanding this success by contour, *failure* would surely result if one face be made contour and shaped most artistically after nature's full-rounded approximal surface and allowed to come in full contact with the undecayed opposite face of its neighbor.

Fig. 8.

But if these same contour gold fillings which have just failed, be so shaped, that nothing but a tiny substantial point is left to merely keep the surface of the perfect tooth from forming this tube, success may surely be prognosticated.

I must add another to my many causes of failure, which is so common with even the very best gold or plastic builders, and which is certainly the most prolific of all others. I have already alluded to it incidentally—the want of method or design when a case, new or old, comes into our hands for treatment. No architect would think of restoring an old structure to its former self without the same outlines on paper, of geometrical and mechanical precision, as in the erecting of an entirely new edifice. How do dental architects make their plans ?

A patient is presented at the age of twelve or fourteen, who has never before been under a dentist's care. The grinding surfaces of the molars, and perhaps of the bicuspids, are carious and need filling. The approximal surfaces, from the touch of explorer and floss, seem perfect. Not a single fissure is left on any grinding surface, but gold is inserted; or, amalgam—not often the latter, as it is so easy here to use gold. The patient is assured no trouble will soon come to any approximal surface ! One, two or three years pass, and a second examination is made, when nearly every approximal surface of the same teeth, on one or both faces, decay is apparent. Not wishing to interfere with the grinding surface fillings, self-cleansing surfaces are made, as in Fig. 3, and small gold fillings packed away, which are also assured. Exit patient for another year, and nearly every approximal filling has been undermined or is defective, or has dropped out; or are loose and cannot drop out on account of the too close proximity of the walls. Again, an attempt is made to save these failures, by making contour and allowing the fillings to go to the bucco-grinding surface and no further, (see Fig. 2,) not wishing to make it L-shaped, by carrying over on to the grinding surface, where rest still the good gold fillings, and there remains between them a wall of enamel, on the very verge of the approximal edge. Now comes failure No. 3, in this same mouth; for in a short time, this bridge of enamel is crushed by attrition little by little, until the contour approximal is valueless; and most likely it is on both the mesial and distal surfaces of one or all. Determined not to lose money and teeth, the injured one returns, hoping it may be the last, and successful for a life-time. Failure No. 4 will as surely be the sequel if done by the same hands, unless he has learned from his folly in not commencing right, and from these regular failures with gold, to try amalgam; and even with this and all other plastics he will again fail unless he has planned and made a chart of his case, observing the law of capillary force.

Now for the parallel as to how success would have been sure had the work been laid out systematically.

The decay in the sulci or fissures, or I will call them more properly, *capillary tubes*, of the bicuspids and molars, should have been sufficient to have warned us that the approximal walls were already or would be so far involved as to call for help. From many such original cases of my own and from others, I was led to *wholesale anticipation*. How can success be better attained? I determined to let but few such cases pass from the use of the explorer and magnifying glass, and instead of waiting for positive evidence of caries on the approximal walls, before any tooth was filled at all on the grinding surfaces, to make an opening with the disk from the lingual side, feeling my way gradually to the buccal side, frequently consulting needle and glass. If no decay was present, and the surfaces could be left with a slight point of contact at the bucco-grinding surface, and no danger from food-secreting, I left it in that condition, as truly anticipated. If slightly decayed, I cut out all I dared, and if too small for a filling, marked on my register doubtful. If decay to any extent has formed I cut boldly through the partition wall between approximal and grinding surface cavities and unite and call it compound. In the early cases the approximal cavity is of no depth, and instead of making deep undercut or retaining pits at the cervix, and on buccal and lingual surfaces, I run the floor of cavity obliquely down to the cervical border, (see Fig. 9,) and also bevel well out on buccal and lingual sides, as in Figs. 7 and 8, without any retainers or undercuts; these depending entirely upon the grinding surface to retain the metal, being sure the floor has no abrupt angle as it turns down toward the cervix, (see Fig. 9,) but as indicated by dotted lines; or as at Fig. 2, instead of commencing the filling as is usual, at the cervical border of the cavity, I generally start at the most distant point on the crown surface, working backward or forward up to cervix, filling up on the approximal side as soon as a substantial floor of gold is laid, to insure a lodgment at the cervix; and in nearly every case contour the wall, occasionally making a flat-face, old-time compound filling, with solid cervix shoulder, (see Fig. 6.) In many such cases I find at that age that both the distal and mesial surfaces on each tooth are involved, and then I carry over from cervix to cervix, making a triple filling, (see Figs. 10, 11,) seldom using regular retaining pits; using a half matrix of hard wood, to barely come above the edge of cavity on approximal wall. If the gold has been well impacted thoughout the grinding surface, it will hold any large contour without special retaining pits, either at the buccal, lingual or cervical walls.

FIG. 9.

FIG. 10.

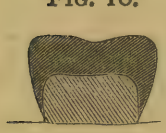
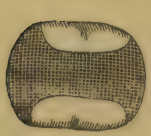


FIG. 11.



Suppose you, with such a design or base of action, that so many failures could have occurred in the cases just cited?

So sure am I in every case that the approximal surfaces will sooner or later be involved, that I no longer fill the crown cavities of young patients with anything else than tin or amalgam, knowing full well that they will have to be removed. And this is another reason why I think so much of plastic fillings. I meet with so many shallow cavities upon opening into teeth for *anticipation* that I little dreamed of, being obscure and high away from the separation where gold cannot be made to remain, and being so poorly shaped, and impracticable to make them so, without greater sacrifice of tooth substance, or by wedging, (Fig. 6,) that I find amalgam is the material to use. In other words, it is adaptable more than any other to these small cavities in young teeth.

Aside, then, from the adaptability of filling material to the circumstances of each case, I know of no more potent cause of repeated failures than in the not laying out the work in the first instance—prospecting, if you please—and also the filling of every little black line on the grinding surfaces with gold, and just to suit our convenience in an indistinct cavity, for the time we may have to spend with the patient.

I must repeat, that if we would be successful we must prepare nearly every cavity in all bicuspids and molars in either jaw, and fill with gutta percha, (pink is good as any, and a little better, if it does not show,) and when we have excavated every surface, approximal and grinding, and know the relations one bears to the other, a second look at such compound cavities may reveal something that was overlooked; and I can, in this second view, mostly find where I can improve them in some way, by this waiting and viewing each entire denture as a whole.

To cut out one or two cavities and fill at once is, as a general thing, one of the worst and most unmeaning operations of which we are guilty, and is unjustifiable. We are too hasty to get through each operation; in my younger days, before I struck upon this plan of prospecting the situation, I filled many a tooth on one side and observed no decay on the other at the time; and, before I let off my patient finally, found that I either had to make a compound filling, by removing what I had before so shortly done, or patch up to the other and run the risk of certain loss of both.

But anticipation, gentlemen, knocks all this in the head. The early practice of this gradually led me to commence earlier and earlier until I found that in the majority of cases, caries sets in as soon as the teeth are in permanent position. Another cause of failure. Acting on the old idea that all cavities *must be filled with gold*,

especially upon the approximal surfaces, (Fig. 3.) I have not cut away the buccal and lingual walls to their furtherest extent, for fear of not being able to fill with gold, and as the pulp in such cases is not very far away, have had to trust to luck in placing it in; a plastic operation would have saved my credit: or, if the position demanded gold, anchoring it from the grinding surface, even if solid dentos had to be sacrificed, as in Figs. 7 and 8. In my earlier days, I failed, often in endeavoring to please the authorities. It takes a long time before one can be heroic and do as *he* thinks best. Experience and observation finally embolden to strong measures. Failures came less frequently when I used Abbey's old-fashioned soft foil. The use of the mallet led me to more cohesive foil and of heavier numbers, but good joints could not be made against weak walls, and capillary tubes were formed from the creases of gold not being in contact with dentos. Where a direct blow could be struck, good joints could be made with hard foil of light numbers. But it was not so much the cohesive foil alone, as my presumption in trying to do too much with it in adapting it to surfaces not possible by physical hands. Now that I depend almost exclusively upon soft foil for nearly every contour as well as simple cavity, next the walls—since I have the means by which it can be impacted as easily and conveniently as the cohesive—failures, I know, are growing less, so long as I can carry out the laws laid down.

I must mention one more cause of failure before I conclude.

The mallet was the legitimate outgrowth of cohesive foil, and upon its heels came stupendous bankruptcies. When I brought out the electric-mallet I fancied there was nothing left for me to do but sit still beside my patient and direct its magic blows. I felt that I could build a *tower of Babel* to reach the heaven of dentistry. It looked as if we could create a tooth and imbue it with new life, and that it was impossible to fail with it. But as great a God-send as it was in preserving physical and mental health, and saving of time and in the perfection in making one piece of gold adhere to another until a solid mass could be formed, "confusion of tongues" came at last. There is a limit to human probabilities and possibilities; and it will not do for us to have an instrument that is too divine unless we know the true zenith and our capacity. Where was the fault? In my attempting to do too much by attaching to weak walls, unsupported by dentine and a thorough base, such towering crowns as my confidence led me to make with that mallet, with the desire to sacrifice no tooth for an artificial one. "I builded well, but not wisely." Similar disasters have occurred to the civil engineer, where he has felt too strong or miscalculated the strength of his base and the material used.

This is justifiable to an extent, since all human efforts are perfected

by failures occurring, and progress made by their investigation, until the laws governing such are fully discovered and made known. I built up everything at first, until necessity drove me to look around for something better and more in keeping with the artistic architecture demanded in the mouth. The failures did not consist in the loss of many of such pyramids; but such cases so multiplied upon my hands, that the cost of such operations forbid their execution; and, notwithstanding the saving of fully two-thirds of the time and labor, by the use of the automatic mallet, the wear and tear upon the nervous system of such as fell into my hands was so great that adaptability, in many senses, stepped in to ask a question whether some other plan would not be easier, and be equally lasting, and enable all to have its benefits.

It was not long before I saw my way clear. It seemed a great humiliation to throw aside the use of gold, which, with our present appliances, we can pack into any tooth, anywhere in the arches, wherever a fulcrum can be had, and feel quite sure of success. How could I destroy so largely the usefulness of my pet? Amalgam came to my rescue, and I am thankful for it, although it is not all we would have, yet it is so far improved, from the discussions of the last decade, that it is lovely to that of the older kinds.

Where I use my best efforts in preparing all cavities, as if all were worthy of gold, and fully destroy all capillary tendency of the dentos with the amalgam, to suck up the semi-fluids, starch, sugar, &c., I can say I am quite happy in knowing the result will be favorable.

But, gentlemen, amalgam, as good as it is, we carry too far without looking around for a substitute which would make the operation more sightly and artistic.

Just here, again, came my relief—pivoting of crowns upon any and all teeth, in either arch, that would be nearly or quite equal, in every respect, to the lost one, and be far less expensive.

Now for my failures in this branch. When, in 1871, I placed on my first pivot with gold-pin gold backings, and a nut to screw crown on to the root, I used gold foil to pack around the pin in the root or roots. I found it impracticable to thoroughly condense the foil at the apex end of the gold pin, to secure it, without cutting away too much of solid tooth-bone, and destroying the integrity of the root. Besides, many roots could not be done at all. Bicuspids and molars could not be done with any certainty, and then only at great expense. I tried oxychloride as far back as 1862, and gutta-percha, for retaining metal pins, but could not rely on them as then made.

Amalgam suggested itself for fixing a platina pin in roots. Not knowing whether it would injure the system or not, I, in a case of

emergency, tried it, and waited results. It met the issue well, and since 1874 I have, with few exceptions, used it in firmly retaining every platina pin. And now, after many experiments, having a porcelain crown that every operator can set, without any gold backings, nuts or screws (as easily as by the old plan of wood pivoting), I feel prepared to practice dentistry as a fine art, depending on the "cursed amalgam" as the bond of union between root and crown, in conjunction with a simple metal pin, sharpened at each end and barbed on the surfaces.

The first plan I instituted, where a threaded pin was securely fixed in the root, and the plate-tooth backed up after the natural palatal contour, with a nut to fasten it on, seemed to the dental world at large such a mechanical effort as to forbid its going into general use, even for incisors. This later effort is, I think, another practical step in placing a means in your hands for wider application, that will insure quite every healthy root remaining in the mouth, and prevent the destruction of human teeth now extracted for artificial dentures; besides, it will enable us to correct many cases of irregularity where almost impossible—and certainly not judicious to undertake—by cutting off the distorted crown, removing pulp, and by the nut and screw method, (see "Cosmos," August, 1880,) we can easily extend the plate from the root to a plate-tooth, in a normal position, and fasten it securely to the root, when it can be removed in case of accident or repairs.

Being so sure of perfect cleanliness and security, for a great length of time, I have no hesitation whatever in sacrificing any distorted or blackened crown among the incisors, and sometimes bicuspids, even if I have to remove the living pulp, where such great deformity is a source of unpleasantness to the patient.

To substitute a crown that will be equal in security to any tooth in the mouth, and be a source of joy and pleasure to my patient, who has not for years enjoyed a good hearty laugh, is more than I can refuse, even if it does look like a sacrifice or piece of vandalism. Of all the operations I have performed, none give my patients so much joy, and none which has linked them in love with me so closely. So self-satisfying is it to their vanity, that they fail to keep it a secret, and reveal it to nearly every one.

For the particulars of my practice in "Anticipation of Decay," I refer you to a synoptical report in the August number of "Cosmos," for 1879.

In speaking of my failures, I neglected to mention those under the anticipation practice, and I will do so here:

First—not commencing soon enough after the teeth were in position, but allowing decay too much headway.

Second—where I did not cut away sufficient of the teeth to completely destroy capillary force.

With some of my older patients, when using the disk, I found the decay so far progressed as to be unable to cut it out completely, without too much sacrifice, and not gone far enough to fill. Such, I had to allow to go over until another six months. These patients occasionally fell into the hands of other operators, and they, not knowing the actual circumstances, said at once, "Here is a failure for Bonwill. It has decayed since he did it."

When I practice true anticipation, it is from the second or third year of childhood, and on until the sixteenth year. To guarantee success, I must have the subjects to see me every six months, and with some, every three months, or whenever a temporary tooth is lost. Each separation is marked on my chart, and the condition of each and all the surfaces at that time and after. In many young subjects, the gums so cover the teeth as to prevent complete treatment the first sitting. I do the best I can for them, and watch closely. With nearly all the teeth of the present generation of city children, I cannot feel that security I desire, if the teeth have been in contact three months. No one can form any true estimate of the extent to which caries has gone, until he has once attempted to anticipate it, when he will of necessity find that he cannot commence too early. To delay is to render it doubtful.

If by early action I have made thorough self-cleansing surfaces by my mode—not Arthur's—and no room is allowed for secretion at any one point, and the oral fluids can circulate freely, then I am sure of success. If from circumstances attending the case I have not been able to carry out these principles, then I must watch closely—and I know just where to go to look for it—not on any one of the cut surfaces, but just near the point of contact, which was not made quite pointed enough, or decay had already commenced too near the point upon which I had depended for keeping the teeth apart. The habits of society are such that cleanliness is not observed, and the foods eaten are so fruitful of death by fermentation, that, until the eighteenth year, we must not rest.

If you depend upon me to-day to say whether there is any hope for the preservation from decay without fillings, from this method, and whether I would recommend it for general adoption, I respond that, so far as my practice is involved, I am positive that in no way am I benefiting my patients so much with the surety of the future success as by anticipation. Yet I shudder when it goes into the hands of the average practitioner, who is unable, both by nature and education, to practice any system of dentistry. But, with intelligence and

judgment combined, in one who is conscientious of his reputation and his patients' greatest welfare, I am willing to trust the results, after he has once seen the plan practiced and fully demonstrated, and has the enginery by which he can do it. The principal fear I have, is not in cutting too much, but in not going far enough.

Aside from all else, there is one consolation attending it: should you not be successful, and are compelled to fill,—and that, either by contour or flat self-cleansing surface,—your tooth is in far better condition than had it not been cut early, when decay was small; decay too is observed sooner by both patient and operator, and there are no such breaches to fill as when allowed to run on until the cervix is involved, and nearly all the approximal surfaces. So long as the gum is sound, and fills up the wide interstice between each tooth, no decay will ever commence on any portion of the wall which it covers. In cases where decay commenced near the grinding surface, and went toward the cervix, its progress was checked when it reached there, and only subdued when the whole inside of the crown was chiseled out.

Then, to attain such an end as I have in view, you have merely to help nature rasp down the broad, flat approximal surfaces, and cut off from both buccal and palatal surfaces enough to leave a delicate and decisive point on that approximal wall as to not at any time remove the enamel entire, but to so shape the faces as to leave no cause for the secretion of food, and at the same time, allow the point to be nearly midway the face, to prevent rotating on its axis.

Permanent molars, superior and inferior, are involved by their contact with the temporary second molars. This observation led me to seek children at the age of two years, and by true anticipation even of the temporary, allow no caries to even have a commencement. Thus, step by step, I went, until I feared to allow any—almost any—of the children of my families to go unchallenged.

In conclusion, let me sum up the points made in my argument:

That the predisposing cause of caries is principally due to the *physical law of capillary attraction*, where two adjoining approximal surfaces are in such contact as to form a capillary tube of the walls:

That caries attacks first the finest part of that tube immediately below the point of contact:

That the point of contact is never first involved:

That the active agent is starch or its products, and their chemical decomposition acting directly on lime-salts:

That decay can be anticipated by timely action and judicious treatment; and, if not arrested early, will surely destroy the tooth-substance of seven-eighths of the children of the present generation, and filling will have to be the sequel:

That decay, once commenced, it is of no consequence whether filled with compatible or incompatible materials; it will not be arrested, unless this same law of *capillary force* is observed, and the approximal surfaces of the fillings and teeth are modeled as I do in anticipation:

That gold, *per se*, will protect dentos from future attacks of caries, if placed in teeth which are best adapted by situation, size of decay, and general surroundings, as to enable an expert in its use to have access to the cavity, and the physical law laid down is observed, otherwise, it will fail:

That amalgam and other plastic fillings will save dentos from future decay, only on the same physical law, and their better adaptability to the situation:

That the theory of incompatibility to dentos, and consequent galvanic action, in proportion as they are incompatible, has nothing to do as a factor in permitting caries to again commence after they have been filled, any more than it is the first exciting cause of caries in solid dentos:

That adaptability of dentos to material, and material to dentos, skilled hands, a brain equal to the task, and the final observance of this law of capillary force, will save, on common physical principles, well understood and capable of demonstration, more teeth, than by acting on the law of incompatibility:

That no theory or law, however positive and well understood, can be applied successfully, so long as we have in our ranks men who are neither compatible nor adaptable to their position:

That, in connection with well-grounded principles of practice, we must have men who are skilled artisans, and who know how to use their digits; with a dental training first, and finally a medical education—so far as the general principles and surgery—the more the better; with such, going out from our schools, we can hope to keep in check, if not annihilate, this monster caries.

To all this we may add that unless dentistry is practiced as a noble profession—and not as a trade—we cannot expect to rise in the world's estimation as laborers worthy of our hire, but will continue to fail, and be set down as mere money makers, and unworthy of our exalted calling.

NOTE.—I have abandoned the triangular platina wire pin for pivoting, for one made of a combination metal that is vastly stronger, and less of the substance if the root is cut away for its insertion. This metal is amalgamated by the mercury in the alloy, which platina will not admit of, and the more firmly holds the crown and root as one.

The regular meeting was held Saturday evening, June 4th, 1881, at the residence of Dr. Daniel Neall, 1627 Summer Street. President Dixon in the Chair.

The discussion was upon Dr. Bonwill's paper, read at the last meeting upon

ADAPTABILITY VS. COMPATIBILITY.

Dr. Bonwill.—Dental mechanical experts should make dentistry their basis rather than medicine. It is best not to place too much faith in what the leading men in the profession assert. Dr. Elisha Townsend made a great mistake in making separations narrow at the cervix—that is, V shaped. My early prejudice against amalgam lasted eight years. I was worked to death by using tin foil. This material wears away very rapidly; I know now that amalgam is better. My researches in dentistry have taught me to reverse many accepted opinions. I do not recognize galvanic action but chemical action, in caries. The majority of teeth that come to us are defective. We will have decay again, no matter what materials we use as a filling, if capillary tubes exist between tooth substance. An artificial crown, in many cases, is far superior to a contour filling. We should compare notes oftener, especially when dentists happen to be in our offices. We should not be afraid of radicals nor extremists. It is impossible to save teeth which come together at the cervical walls, if the cavity is allowed to come to a point there. They should be cut square. Some that I filled in this way twenty-five years ago are still preserving the teeth. I resorted to the contour method, when the principle itself was not known. Since I went into anticipation, I have fallen upon cavities of decay which would be impossible to treat, except by contour. I insist upon children coming to me from time to time; anticipation will be successful only when children are seen from four years of age up. If decay has begun, there will not be so much chance of success. I have found many cavities in this way, upon which it was impossible to practice anticipation, or even simple filling. Two-thirds of the operations of anticipation upon molars and bicuspids, save them without filling at all. Seven-eighths of those saved are incisors and cuspids.

Dr. D. Neall.—It seems singular sometimes to note the landmarks of time in dentistry. One of the most curious of these is, that the inventor of the electric mallet has become a most pronounced advocate of amalgam. Another, and one which is most significant and striking, is the rebound from the decorative abuse of gold in favor of plastic material. Two or three in my office, who have worked themselves to exhaustion in the excessive use of gold, have now found in

amalgam and other plastics their friend; and that they, with others, can save teeth by processes which are more eclectic. I have removed remnants of gutta-percha fillings which have been in cavities for ten or twelve years. I don't yet admire cohesive gold as many do; I happen to know a great many cases of "soft" gold fillings which have been doing good service for thirty or forty years. Years ago I commenced the practice of filling cavities of decay on the cervical margins of gold fillings, with amalgam, and deprecate the practice of removing old fillings merely because there is slight decay or imperfection at these points. I have no ambition to pull work to pieces because I may start a better filling.

Dr. Webb.—I have said many times during the past few years, that I cut away freely towards the buccal and palatal or lingual surface of the bicuspids and molar teeth, and at the cervical margin of cavities, so as to make all the edges of enamel free from contact. Calcification is often imperfect, and in all such cases the edges of enamel ought to be free from contact with any part of the teeth adjoining, and restoration with gold should be full and complete.

To perform fine or first-class operations, or to do genuine contour work (and this ought to be done in all cases,) it is necessary to use cohesive gold foil, folded and cut into narrow strips; and this should be put in place by the aid of the mallet; all which requires time and care to be made useful and permanent.

Patients endure operations just in accordance with the way they are handled by the operator; and he must first gain the confidence of his patient by being conscientious and sincere, and by showing that he knows exactly what he is about. He should always feel that he has living tissue to operate upon; and, while he ought to be kind and sympathetic, he can also handle his patient nicely and gently and perform his operation thoroughly. It need not often be necessary to keep a patient in the chair over two hours. I have known patients to suffer far more pain and fatigue in about an hour in having some ordinary, and, perhaps, almost worthless fillings inserted by unskilled and careless hands, than during the performance of an extensive, difficult and fine operation, requiring a properly qualified practitioner four hours to perform.

The regular meeting was held Saturday evening, October 1, 1881, at the residence of Dr. Dixon, 4055 Spruce Street, Dr. Dixon in the chair.

REPORTS OF DELEGATES.

Dr. Darby.—I attended the International Medical Congress held in London, and was present at many of the sessions of the section known as Diseases of the Teeth, but do not know that I have any formal report to offer. The congress was largely attended by gentlemen from all parts of the world; the number representing our specialty was quite large, and a fine opportunity was afforded for becoming acquainted with men whom America had long known only by reputation. From a social stand-point the International Medical Congress was a grand success. The profession residing in London did all in their power to make it a source of pleasure as well as of profit to the members who attended. It would be difficult to surpass in elegance the entertainments which were given. There were several papers read before the section on Diseases of the Teeth, some of which were of considerable merit. The one which interested me most was by Dr. Coffin, Sr., upon the "Correction of Irregularities." His methods were very simple and his accomplishments very great. From the vast number of models exhibited and the great variety of cases described, I should infer that Dr. Coffin made a specialty of this department of practice. The chief appliances used were rubber plates and springs of piano-wire. Dr. M. S. Dean, of Chicago, read an interesting paper upon the treatment of alveolar abscess. Dr. Webb also read a good paper upon his method of filling. Dr. Coles, of London, also read an interesting paper. Time will not admit of a detailed account of either. It is probable that they will appear in the transactions of the congress. I was shown while in Paris a very ingenious little lamp for illuminating the mouth and throat. There are times when an instrument of the kind would be very useful to the dentist.

Dr. Guilford.—In one of the dental depots in Paris I saw a very ingenious electrical machine designed for cauterization and illumination of the mouth and throat. It was very complete, compact, and cheap, but in my opinion of no practical use to the dentist. I also saw a water globe with an adjustable gas-burner back of it, the whole mounted on a bracket. It was such as are used by some of the London dentists on dark days for throwing a concentrated stream of light into the patient's mouth, and thus enabling the dentist to operate.

Dr. J. Truman.—I attended the State meeting, and considering the difficulty attending gatherings of this kind, the meeting of the

present year was a very large and interesting one, about ninety being present, a number from New York and neighboring States. A number of excellent papers were read, several of which ought to enter at once into the general thoughts of the profession, but owing to the bad habit of publishing proceedings in book form, these cannot reach the reader until a late day. The committee on prosecution under the State law made their report, and in both instances where legal proceedings had been carried through they had resulted in the acquittal of the defendant.

INCIDENTS OF PRACTICE.

Dr. Darby.—I have in my possession models of the upper and lower jaws of a man about 20 years of age; he has never had any teeth in the lower jaw, and had but two teeth in the upper jaw; these are molars. He is wearing a lower plate with the full complement of teeth upon it, and an upper plate with all save the two molars. The dentist who sent me the molars assured me that the person had never erupted a temporary tooth, nor has he ever had any permanent one except the two molars of the upper jaw.

Dr. J. Truman.—My attention has been called prominently the past week to the action of arsenic upon the pulps, and I desire to learn the views of members this evening upon certain points that seem to me to require some investigation, and in order to arrive at it I will place the thoughts in a series of interrogatives. First, then, I will inquire, if arsenic be placed in a cavity with a thin layer of dentine covering the pulp, and the latter not exposed at any point, it is well known that the pulp sooner or later is destroyed. How is this effected? That it will pass through the tubuli traversing the soft tissues therein contained and continue its destructive force until the pulp is destroyed is self-evident, but I desire to be enlightened as to the process by and through which this is effected. We have been using arsenic empirically since 1830, and it would seem to be about time to know how it acts to produce the death of the tissue. Does it produce paralysis of the nerve of sensation, and by this means cut off nutrition? Is it carried into the circulation, and if so, what are the limits of its action? Does it in the case cited produce congestion in the pulp, and consequently increased expansion and a more extended inflammation? These are important points, and bear directly on pathological conditions met with in practice. Second, What is the effect of arsenic on partially devitalized pulps? We know that congested pulps resist the action of arsenic to an extent that renders its use in this condition impossible, but I am not positive as to the effect that may be produced when devitalization has been only partially

affected. Third, What effect is produced by arsenic when applied to a dead pulp? Could it be absorbed, and if so, would it be possible for this to be extended to the pericementum? A proper knowledge of the effects under such conditions becomes of importance when we remember how common it is for dentists to carelessly diagnose cases presented for treatment. Pain resulting from a slight pericementitis may be mistaken for an exposed and irritated pulp. Fourth, How soon after the application of arsenical paste may it be possible for alveolar abscess to supervene? The answer to this that I would give would be, that pericementitis could not, under ordinary circumstances, take place until decomposition of the pulp-tissue had taken place, and that this would be delayed by the preservative quality of the arsenic. In my observation it cannot be accomplished under from ten days to three weeks, and the pulp may remain in a state of quiescence for an indefinite period. The query that follows the main question to my mind of most importance is, Would it be possible for alveolar abscess to follow directly from the application of arsenic? My own judgment and experience are in opposition to any such idea. It is not at all uncommon for pericementitis to follow the application, but this is only temporary in character and speedily yields to proper remedies.

Dr. Essig.—My impression has been that arsenic is a preservative of dead tissue. As long as arsenic remains in a tooth abscess is not likely to occur from decomposition of the pulp. I have heard of a case in which arsentical applications had been made to a pulp, the patient not returning for six months. The dead pulp is not capable of taking up the arsenic. I agree with Dr. Truman that a careful diagnosis should be made. We should always find out whether or not pain arises from a putrescent pulp. We can ascertain by certain means. If a pulp dies from any cause and air is admitted, putrescence will take place.

Dr. T. L. Buckingham.—I experimented several years ago with arsenious acid to find out its action in such cases as Dr. Truman refers to, but I do not know that my experiments resulted in any satisfactory conclusion. The trouble is, we do not know how most medicines act. We know their effects by repeated trials, and as they have acted uniformly in a number of cases, we conclude that they will act in a similar manner in others. If we take morphia, quinine, or strychnine, we know they act differently, and yet they are composed of the same elements and in very nearly the same proportion. Now, if they were decomposed in the system they would be inert as a medicine, for the elements of which they are composed we are eating and drinking and breathing constantly. They must act as a compound by their pres-

ence in some manner not understood. It is so with arsenic. It is not a true escharotic which would act chemically like nitrate of silver, but it destroys the vitality by its presence, and decomposition takes place afterwards. When applied to the pulp of a tooth it appears to only suspend the vitality and make it insensible to pain, so that it can be removed; or it may entirely destroy the vitality, so that after a time it will decompose. The effect is not to destroy the composition of the pulp, as a true caustic would, but only its vitality; and it preserves the tissue, so that its decomposition does not take place until the arsenic is removed. I tried experiments several years ago by mixing a solution of arsenic and the albumen of an egg; then boiling so as to coagulate the albumen; afterwards I put it in water and changed the water until not a trace of arsenic was left in the albumen; I repeated the same with a piece of beef, only I did not boil, with the same result. This corresponds with all crystallizable compounds that are absorbed by animal tissue and do not combine chemically with them. They all may be dissolved out. I think arsenic sealed up in a cavity of a tooth will be dissolved by the fluids and removed before the pulp will decompose, but I do not think the dissolved arsenic would pass through the foramen in sufficient quantity to produce inflammation in the surrounding parts. Dr. Truman has said something about inflammation; we know very little more about it than arsenic. We recognize the phenomenon of inflammation, and know something about its termination, but the cause of this phenomenon is still a mystery.

Dr. J. Truman.—Is there any limit in the absorption of arsenic?

Dr. Buckingham.—When arsenic is applied in sufficient quantity to a diseased part, or a tumor in a low state of vitality, it produces the death of the part, which is then in an unfavorable condition for absorbing it; and this is probably the case with an ulcerated or inflamed pulp; hence the advantage of using creasote with it, which will coagulate the fluids of the tissue. Cases have been reported where the arsenious paste has been left in the teeth for months without causing serious trouble; when arsenic has been applied to a pulp which has been made to bleed it is more likely to be absorbed.

Dr. Darby.—I do not think we understand the action of arsenic upon tissue. The general belief is that it is absorbed by the tissues, and is readily taken up by the circulation. Very little is required to devitalize a healthy tooth-pulp. Dr. Flagg professes to have devitalized ten pulps with the twenty-fifth of a grain of arsenic. He says:*

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*New York Odontological Society, regular meeting, extra session, December 20 and 21, 1875.

"Then came the action of arsenious acid, one twenty-fifth of a grain in a piece of cotton; mixed it with acetate of morphia, the whole being in turn mixed with creasote; placed it in a pulp cavity and devitalized that pulp. I made that same application to a number of teeth, and I left the cotton in each for two weeks, and in some, I think, for three weeks. Each one of those pulps I extracted from those teeth painlessly. It was a perfect devitalization of the pulp. They were taken out and held up before my patients, and they were told, 'That is the pulp of your tooth,' and when I held this up, and told them, every one of the ten said, 'Is it possible that you have taken that from my tooth without my knowledge?' If they did not know it, it could not have hurt them much. These pulps were then placed on paper, the terminal ends where the arsenic came in contact with them were cut off, and the remainder of the ten pulps analyzed in a bunch. They were treated by Reinche's test for arsenic, which detects a two hundred and fifty thousandth of a grain, and there was not the ghost of the shadow of a show of arsenic. Now, if there was not the ghost of a shadow of a show in ten pulps, how much was there in one?" Arsenic does not act readily upon an inflamed or congested pulp. To produce the best results all inflammation or congestion should first be removed. In answer to Dr. Truman's third question, I would say that I do not think arsenic would produce any effect upon a pulp devitilized; I should not expect it to act either upon the pulp or other tissues of the tooth.

Dr. Essig.—I doubt whether arsenic finds its way through the structure of the tooth, producing inflammation. If it did so, much harm would result on account of the extensive way in which it is used. By watching the effects we may know the results. If it goes through the tissues and affects the pericementum, we will have pericementitis.

Dr. Buckingham.—Arsenic is an elementary substance, and can be detected in smaller quantities, than any other poison. Some years ago I tested for arsenic in the tissues of a frog that had been poisoned by applying nerve paste to the web of one of its hind feet; I found indications of arsenic in every part of the body, showing that the poison had been absorbed and passed through the whole system. Arsenic may be taken as a medicine for a long time without producing any deleterious effects.

Dr. Darby.—I doubt very much whether arsenic goes through the apical foramen of a finely developed tooth. There might be danger in young subjects before complete calcification had taken place.

Dr. Guilford.—I would like to know whether it is possible for the arsenic to pass through the dentine and cementum, and cause periosteal trouble. I do not believe it possible, at least, in any reasonable

time. If the arsenic is hermetically sealed in a tooth, no harm to the periosteum can arise from it. In the early years of my practice in a country town, a patient came to me from a distance with four pulps exposed in four superior bicuspid teeth. I applied arsenic to each and sent the patient away, directing her to remove the application the next day. She did not do so, and when I saw her again, in four week's time, it was still in, and a piece of necrosed septum had to be removed from either side of her jaw. In this case the trouble undoubtedly came from the arsenic oozing out from around the cotton and sandarac stopping.

Dr. Buckingham.—It may be absorbed by the dentine. We know it will pass through the dentine and affect the pulp when applied in superficial cavities, and why not pass from the pulp cavity out into the dentine. It would probably not pass out in sufficient quantity to induce inflammation in the periodontal membrance. We must bear in mind that arsenic, in dilute solution, will be tolerated by the tissues without injurious effect. If nerve paste is applied carelessly, it may get on the gum and cause inflammation of the gum and necrosis of the bone.

Dr. Tees.—I seal in all applications with Hubbuck's oxide of zinc, and the solution of chloride of zinc, for sale at the dental depots. This hardens within two minutes, is very plastic, and prevents leakage.

Dr. Jos. Pettit.—The patient, of whose mouth this is a model, is a boy aged ten years, who, while in the country about a month ago, fell, fracturing diagonally the left superior central incisor, as you will notice, nearly to the pulp line, so near that the surface is quite sensitive to the touch of an instrument. Three methods of treatment, in cases of this kind, present themselves to my mind. The tooth might, with the help of retaining screws, be built up with gold, but the pulp is so nearly exposed that thermal changes would probably cause its death, with consequent cessation of root development, besides which such a mass of gold is very unsightly.

The crown might be cut off and an artificial one adjusted, but at this age, with the root not thoroughly formed, such a course would not be wise. Probably the most conservative course would be to protect the surface with oxyphosphate, for the purpose of retaining the vitality of the tooth, with a view to permanent operation in the future. I mention the case, desiring a comparison of ideas and the opinions of the gentlemen present.

Dr. Guilford.—I would drill two holes in the tooth at the fractured portion, one vertically and one horizontally. In these I would set small pieces of gold wire with oxychloride, and then around these I would restore the corner with oxychloride or oxyphosphate.

DR. DARBY.—If possible I should save the life of the tooth until the root is fully formed, and then cut it off, and engraft an artificial crown.

The regular meeting was held Saturday evening, November 5th, 1881, at the residence of Dr. Daniel Neall, 1627 Summer Street.

The following amendment to the By-Laws, offered by Dr. Essig, at the last meeting, was passed :

Sec. 1.—Members of this society taking office students shall require of the latter satisfactory evidence of a sufficient preliminary education, the minimum of which shall consist of a thorough knowledge of orthography, reading, writing, grammar, and geography, together with a knowledge of the principles of physics.

Sec. 2.—A diploma from any chartered literary institute shall be deemed sufficient evidence of an applicant's preliminary educational qualification.

Sec. 3.—It shall be the duty of a properly appointed committee of three members of this society to examine the applicants for admission as students in the office of members of this society, when requested to do so by a member.

INCIDENTS OF PRACTICE.

DR. DARBY.—While in England, the past summer, my attention was called to the superior qualities claimed by many of the English dentists for Sullivan's Copper Amalgam. This preparation is said to be composed of copper and mercury only. The advantages claimed for it are its absolute freedom from shrinkage and its great hardness. It has one decided disadvantage, however, and that is the marked discoloration which it presents after having been in the mouth a short time. I obtained some of it through Dr. Claude Rodgers, and have made several fillings of it since my return. Thus far, I am much pleased with its working properties, and in positions where discoloration need not be a serious objection, I think it may be used with satisfaction.

I will show you the preparation, and will demonstrate the method of using it.

Some years ago, I remember to have seen fillings made of Sullivan's Amalgam in the mouth of an English dentist. Although there was great discoloration of the fillings, the edges were very sharp, and I was then impressed with the value of the material. I do not bring it before the society to endorse it, but simply to get an expression of opinion and state what little I know about it.

Dr. Jas. Truman.—I have been familiar with the amalgam exhibited for several years. It is extensively used abroad, and is considered to possess the advantage over the other forms, that it does not shrink. It is a serious question whether we are doing right to make use of such materials indiscriminately, without an absolute knowledge as to their effect upon the general system.

Dr. Jack.—My experience with amalgam has not been considerable, as I have used it only when, from various unfavorable circumstances, it seemed out of my power to secure good gold work. But I have, from this experience, become convinced that amalgam gives no immunity from caries at cervical margins, on account of any peculiar quality it possesses. I regard a good amalgam filling as only simply better than an indifferent gold one. I speak, of course, of teeth of such structure as will endure the pressure required to produce the necessary consolidation.

I have found decay so frequent, at the cervical part of the teeth, by amalgam fillings, that my confidence in the conservative power of the material is much lessened, and I might say that none of the newer formulas of amalgam, while less unsightly, do exert as good preservative properties.

Dr. Darby.—I have long noticed that when amalgam and gold come in contact in the same tooth, that there is always a greater discoloration of the amalgam than when the two do not touch. I have also observed that the edges of the amalgam which come in contact with the tooth, are much sharper, and there is less appearance of shrinkage. I am firmly of the opinion that it is good practice to let gold and amalgam meet in the same tooth. Just what changes are produced by this union, I am unable to state, but there is undoubtedly some change taking place, which is beneficial to the filling.

Dr. S. G. Perry is in the habit of cutting a channel one-sixteenth of an inch deep, around the margin of his large amalgam fillings, after the amalgam hardens, and then fills this channel with gold; by so doing, he secures a close joint between the enamel of the tooth and his filling. I have seen such operations from his hands, and they have always been good.

Dr. Essig.—I have observed what Dr. Jack refers to, and believe that there is no more immunity from decay when amalgam is used at the cervical edge than when gold is used. I think there is a good deal still to be learned about amalgams.

With the few metals commonly employed for the purpose, almost innumerable results are attainable.

Dr. Register.—I have noticed, and carefully noted, that teeth of a certain quality, re-decaying at their cervical walls, when filled with

amalgam at this point, when in communication with gold, remain perfect for many years. I had this forced upon my notice through several failures with gold alone, and at last resorted to amalgam, at this point, temporarily to bridge over a stated time for an unanticipated European trip.

I now generally, when finding an otherwise perfect gold filling breaking down at the cervical portion, cut away the immediate decay and fill with amalgam, in direct contact with the gold. My impression is, this combination of metals forms a galvano-plastic which decomposes irritating acids, which would otherwise attack the lime salts. A primary battery of acids attached to a secondary one of metals, will deplete itself in charging the latter, and then will, in part, flow back until drawn off and used by interruption; and this flow continues back and forth each time, becoming less and less, until the current (for it is a current, and not undefined,) ceases, and there is an equilibrium established—and this, to my mind, is what we have in the mouth by the union of metals.

Dr. Jas. Truman.—The use of tin and gold, as recommended by Dr. Abbott, of Berlin, is based on this idea. The continual failure at cervical margins has led to a change of practice with many. The superiority of tin and gold led Dr. Jenkins, of Dresden, to use it in all approximal surfaces of bicuspid teeth, at the cervical margins. The galvanic action confined itself to the metals in combination, resulting in a dark, hard body resembling amalgam, both as to color and density, but effectually protecting the margin from decay. Experience is altogether on the side of patched cases with amalgam, and should be more resorted to than has been heretofore the case.

Dr. Register.—I think the condition the same between any combination of metals.

Dr. Jack.—I confess I have learned something this evening, in reference to repairing gold fillings in difficult situations with amalgam, my previous inclination being averse to combining two such apparently opposite things.

Dr. Tees.—I have been requested to give my experience with Watts' Crystal Gold. I have been using it for the past ten years, in approximal cavities; and three years ago, when Dr. Watts reduced the price to that of foil, I threw aside gold foil, and have been using crystal gold exclusively, ever since—and it has saved me a great deal of time and worriment. With properly serrated points, with the mallet, and by dividing the gold, by means of a sharp razor, into slabs one-sixteenth of an inch in thickness, beautiful results can be accomplished. I have filled cavities with comparative ease, with it, into

which myself and others have failed to pack gold foil successfully. I cannot lay too much stress upon this manner of dividing the gold and upon the use of the mallet. Much more gold can be packed into a cavity by the mallet than by hand pressure.

Dr. Darby.—My experience with Watts' Crystal Gold corroborates what Dr. Tees says. I have used in it my practice, more or less, for fifteen or eighteen years. Some of the best operations I have ever made have been done with crystal gold. My objection to it in the past has been its tendency to deterioration when exposed to the air. In large operations and in cavities easy of access, nothing is better than this preparation of gold. I can point to entire crowns restored by its use years ago, and in good condition at the present time.

Dr. Tees.—The deterioration is caused by the absorption of moisture, and to restore its cohesive qualities, it should be subjected, for about a minute, to a gentle heat, by placing it upon a piece of thin platina plate or a piece of mica, over a small flame of a spirit lamp.

Dr. Essig.—The purity of crystal gold, is insured by its mode of preparation—electrolysis.

This is not the same kind of crystal gold used many years ago. Lamms' gold was made by precipitation in an acid solution, and then adding gum arabic to it; webs of gold appeared, and if certain precautions were not taken, it became powdery.

Dr. Truman.—From some considerable experience, in past years, with crystal gold, both practically and experimentally, I have not been favorably impressed with it. The difficulty of condensing the crystals properly at the edges, left the filling there in a spongy condition, followed naturally by absorption of the fluids and subsequent discoloration. This defect seemed inherent in the material, and was not apparently dependent on this process of manufacture.

Dr. Pettit.—What was the form of the crystals?

Dr. Jas. Truman.—There is evidently an erroneous idea in regard to the form of gold crystals. The fern leaf deposition is simply an aggregation of crystals. When isolated, they have the usual form common to all crystals.

The regular meeting was held Saturday evening, December 3, 1881, at the office of Dr. W. G. A. Bonwill, 1719 Locust Street, President Dixon in the chair.

INCIDENTS OF PRACTICE.

Dr. Kingsbury.—I feel interested in the Richmond crown. Some time ago Dr. Richmond came to my office and inserted a crown for one of my patients, which is doing good service. About two years and a half ago I inserted a modification of a Richmond crown for a patient, using oxyphosphate of zinc. It has stood until the present time. The gentleman was so well pleased that a few days ago he came to have a similar operation performed. The root being in good condition, I inserted a Richmond crown; it required one-half a day for the operation, but it gives promise of durability.

Dr. Essig.—Several years ago I filled several large cavities on the grinding-surfaces with gutta-percha, covering with a piece of pure gold swaged to fit. Every one has been successful. Have seen them every six months for four years. After the cavity is filled with gutta-percha, an impression of it is taken. A piece of pure gold is swaged to fit, a piece of platinum wire soldered to it, warmed, and pressed into the gutta-percha. I have inserted several Richmond crowns. They have done perfectly well, and promise to last years. I use oxy-chloride of zinc.

Dr. Guilford.—I have set two gold bicuspid crowns on the Richmond plan, and they are fully equalling my expectations, although each has been worn several years. They were set with oxychloride of zinc. In each case I drilled a small hole, as an air-vent, between the cusps, so that I might have no difficulty from that source in driving them home; it also allowed the surplus cement to escape through it instead of at the neck, which I had taken care to fit very accurately. A day or two afterwards I plugged this vent with foil. I made the crown of medium twenty-two carat gold plate, and built up the cusps with layers of plate and soldered in the usual way.

Last summer, in the office of a dentist, I saw a novel method of producing the cusps in a simpler way. The gentleman had taken a half dozen natural bicuspid teeth and imbedded them in a block of plaster, leaving only the cusps and masticating-surface protruding. In the same way he had prepared blocks of various sizes of superior and inferior molars. These he reproduced in zinc and made lead counters for them. After bending his plate to form the body of the crown, he soldered it, and then selecting a crown on his zinc-die to suit it, he struck up a cap which he soldered to the body. This

lessened the labor of making and polishing the cusps very considerably.

In regard to the Bing method of attaching a pure gold cap to a gutta-percha filling, the first one I ever saw was made in my laboratory by Dr. Bing, in 1876. He shaped it with the pliers. In the one (only one) I set shortly afterwards, I filled the tooth with gutta-percha, shaping it to fit the antagonizing tooth. I then took an impression of it, made my die and counter and swaged the cap, which was thus sure to fit in every way.

Dr. E. R. Pettit.—I have inserted thirty or forty of the Bing caps, all, I believe, in compound cavities, and, so far as I know, a large majority of them have proved failures. They are good only where a good foundation can be obtained, as in other cases the force exercised in mastication when gutta-percha is used will very frequently fracture the weak crowns of these teeth; while if osteoplastic be used it will dissolve out. In a few cases I have been successful with them, but I do not consider them equal to other methods of filling teeth, and I have consequently abandoned their use altogether.

Dr. Darby exhibited specimens of Watts' crystal gold under the microscope.

Dr. Tees filled a large cavity in a molar tooth imbedded in plaster with Watts's crystal gold. The gold was cut into slabs one-sixteenth of an inch in thickness by means of a razor, and annealed upon a piece of platinum over the small flame of a spirit-lamp. He used points especially adapted for this kind of gold, condensing with the hand-mallet. He has used crystal gold successfully for over ten years, and for the past three years has used no other kind.

Dr. Kingsbury.—I used Watts' crystal gold as soon as it was introduced. I can show a filling of crystal gold inserted twenty-five years ago, still bright and beautiful. At that day some batches of it were good and some not. A large number of fillings inserted then are, I suppose, good to-day. But since the various forms of gold foil make equally as good work, I see no great advantage in its use.

Dr. Buckingham.—What is the difference in the preparation of cohesive and non-cohesive gold foil? I have asked a number of persons, and have not been able to ascertain.

Dr. Essig.—The surface of non-cohesive gold foil is carbonized. Fully cohesive gold is annealed in a blue flame; semi-cohesive in a yellow flame.

Dr. Register.—I can make non-cohesive gold cohesive by heating it to almost white heat.

Dr. Buckingham.—In regard to the welding of gold in the process

of filling, all metals condense gas upon their surfaces; some more than others. Palladium foil condenses, at a temperature below 212 degrees, 643 times its volume of hydrogen; and sponge platinum will become red-hot when hydrogen gas is projected upon it. Gold foil will float upon water, although it is nineteen times heavier. Have tried to weigh a sheet of No. 4 gold foil in water, and found its weight to be about one grain, while it weighed four grains out of the water. The difference in weight is attributed in a great measure to the gas adhering to the gold, which prevents it from cohering.

1882.

The regular meeting was held at the office of Dr. H. C. Register, 1907 Chestnut Street, January 7th, 1882. President Dixon in the chair. A paper was read entitled

PLASTIC GOLD ALLOYS.

BY W. G. A. BONWILL, D. D. S.

There is no true man of experience in our profession who has not longed for some plastic material to use as a substitute for gold foil in many operations. This desire has led many to enter into experiments upon some of the old amalgams, and, in a few cases, to bring out new combinations. Their efforts have not been futile, as much progress has been made. The discussion regarding galvanic action led many astray in searching for an alloy containing the smallest amount of gold,—just sufficient to cause it to harden somewhat more rapidly,—and also to bring in combination other metals that would set up galvanic actions within themselves, to the better preservation of dentos.

I had hoped much for the "new departure" alloys, but the principles involved seemed to me to be incorrect, and I was forced to look further. The alloys made by this school aim to supplant gold with other metals. Some are prepared for quick setting, making use of metals as before stated, having galvantic action among themselves, and not on the dentos. My experience in gold working was different from theirs. I felt that if gold could be more largely used in alloys there would be less oxidation and dissolving of tooth-substance. Whether my experiments will prove all I had hoped for remains to be seen; so far, the appearance of operations performed more than a year ago is satisfactory, and, I believe, indicates a move in the right direction. The experimentation necessary to secure an alloy adapted to setting crowns led me into the extravagant use of fine gold foil in

connection with mercury. I found that seven per cent. of gold placed in the alloy of pure silver and tin, in connection with specially prepared mercury, containing a small quantity of pure gold, would give an article such as I wanted for pivoting purposes and for the base of large fillings. This gave less discoloration, was quicker in setting, and more solid under compression than any other. It was absolutely necessary that the mercury should take hold of the alloy immediately, and that no time should be wasted in rubbing it in a mortar or in the hand. It was also desirable that no valuable time should be lost in washing or pressing. The mass must become grainless at once, and perfect amalgamation be insured before leaving the hand or mortar. Only slow-setting alloys need compression with pliers. To secure this the proper treatment of the mercury is a very important matter. This preparation of the mercury, used with an alloy containing a larger percentage of gold than any I could purchase, led to a further step. Seven per cent. of gold in the alloy would work well, and not set too quickly, if the shavings were very fine and clear, provided that the mercury was absolutely pure, and that no time was lost in amalgamating, and the right quantities of alloy and mercury were used; and provided, further, that the silver and tin were proportioned to that per cent. of gold. More than seven per cent. I have not found useful in the alloy. It was a question whether or not it would set quickly in this shape, and have sufficient edge-strength or retain plasticity long enough for contouring or conforming to the walls of the cavity. Time alone could tell. Sufficient tests were made out of the mouth, in tubes and porcelain crowns, to justify a trial in the mouth. The experiment was necessarily costly, and might have resulted in much damage to the teeth operated upon and caused me much annoyance; but it had to be made. The results have amply justified the operations. I had my cases come back frequently for examination, when with a strong lens I examined them to see if any defects could be discovered at the edges, and whether or not there was any oxidation, bulging, or displacement of the mass. In one case, where I had placed many very large contour fillings in the teeth of the lower jaw, in a month whose secretions were well calculated to discolor even gold itself, I found one side in good condition and satisfactory, and the opposite one oxidized and darkened. Examination soon revealed the cause to be that the rubber attachment on the gold plate was in contact with the fillings, and that the sulphur had united with the silver in the alloy. This was corrected, the filling again smoothed and polished, and, so far, discoloration has never recurred. A few fillings have discolored or tarnished in very acid saliva, but no oxidation on the surfaces or destruction of the metals at the margins, as in the one above cited, has become apparent.

The treatment of gold with mercury is, I believe, new. Some have informed me that they mixed fine foil with mercury at the time of preparing the alloy for filling, but never kept it for use in the finely-divided state. If success is possible through mixing gold and mercury, it can only be secured as herein described. It is singular that the alloy does not set as rapidly with the twenty-per-cent. gold-mercury as with the mercury alone; and it can be manipulated longer in the mixing, and while being placed in the cavity of decay. It requires nearly an equal quantity of the twenty-per-cent. gold-mercury to mix with the alloy, while with the plain mercury at least one-third less is sufficient to harden it. The fine gold which has been perfectly amalgamated by the mercury goes to the silver and tin of the alloy on mixing, to become mechanically and thoroughly incorporated with it. The smoothness and plasticity of the mixture is remarkable, the change being immediate; not requiring many minutes, as with those alloys containing no gold, or but a trace of that metal. Discoloration will be observed on the fingers as the result of its fineness, and from the fact that pure gold is oxidized when brought in contact with mercury. In such mixtures there is no necessity for washing or pressing. The mass is so dense that if the proper quantity of mercury be used it will be difficult to wash it. If the little free mercury contained could be pressed out of it, the mass could not be molded into contour, or made tight against the walls of the cavity.

In the use of these alloys no more mercury should be taken in the hand than is required to make a thick mass. A little might be pressed out with the fingers, but it would be difficult. When placed in a cavity bibulous paper should be laid over it, and a blunt-pointed plugger used to condense it. The paper keeps the mass from slipping away under a smooth or even a rough instrument. Whatever amount of free mercury may be in it is forced to the top, and is wiped off or taken up mechanically by the paper. The mercury should never be allowed to concentrate around the margins, where edge strength is so desirable. Where the fillings can be reached with the fingers, the mass can be made free from mercury by pressure with paper. The fingers are admirable adjuncts in plastic work. Wet bibulous paper is excellent for giving contour work the final touch.

Where fillings are large, several mixings of the alloy with mercury must be made. It cannot be expected that even an expert could take a large mass of this alloy and use it before a change occurred by crystallization.

There is great gain for an extensive contour filling in mixing at least three times. Where there are several small fillings to be made, let them all be prepared beforehand, and then what is left from one

filling can be utilized in another, thus saving much material. By first pouring the mercury in the hand there is less chance for waste, and it will not be necessary to weigh the alloy or mercury if the operator is quick in his movements. Everything must be in readiness for filling before the mixing is begun, or hardening will commence and cause the loss of the mixture.

There is one thing that must be observed in the use of any plastic alloy, if success is to be looked for, and that is the necessity of so preparing the cavities that no very acute angles of alloy are presented on the grinding or other surfaces. The walls should be covered with a thick body of the plastic, or, if not entirely covered, the exposed part should be so shaped as to present a perpendicular line to the pressure exerted thereon, or the filling on its margin next to such exposed edges of the wall should be so obtuse that there will be no possibility of its giving way during mastication. This is a very vital point, and hundreds of teeth have had their buccal or lingual walls broken from want of such protection, even where gold had been used. I cannot emphasize this too strongly. It is so easily done with small corundum points that there can be no excuse for its omission. In many cases it is better to remove a portion of the antagonizing tooth, though solid and perfect, in order that the walls may be well protected with the alloy. When this is done, the most fragile alloy will secure such wrecks equally with the finest gold filling, and better in many cases. Where the cavities are approximal, the most minute and difficult to fill can be reached without cutting away so much of solid tooth-structure as when gold is used.

I have found that, where gold fillings need patching, the twenty-per cent. gold-mercury filling keeps its color remarkably well, while others with less gold discolor badly. This observation I think can be relied on, and, if true, is of some importance. It is certainly inevitable that the practice of the future will make less use of gold, and that a better class of alloys containing gold will be introduced and used in proportion as confidence increases in a good article. It will not only be more economical, but the remuneration for services will be equal to that for gold work.

Until the cheap amalgams are abandoned, we need not hope for better work from plastics; but the period is drawing near when those who never were and never will be good operators in gold will be enabled to perform better operations for their patients. The fear that plastics will lower the standard of the profession is absurd. Let every man be properly educated, and then it will not matter what he uses if he has the qualification to stamp all he does with success. The public desire that which will preserve the teeth from further decay,

and retain, as far as possible, their beauty and symmetry. Patients only know what is taught them by their dentist. Mine respect me when I tell them I am not willing to use gold as liberally as heretofore, but prefer an alloy in special cases. Some, who have just come from the hands of others who use gold almost exclusively, make some objections at first, having been educated to believe that gold was superior to all other metals. When, however, they are reminded that failure has occurred in three-fourths of the large operations, and are assured that the alloys can restore the contour of the cut-away, decayed, or broken teeth, and can be made far more useful than the old flat-faced, narrow, self-cleansing-surfaced filling, they arrive at correct conclusions.

With plastics contouring can be accomplished with success, though requiring skilful manipulation; but contouring with gold is such a strain on the nervous system that few can or will bear it. Opposition to the inevitable is useless. We must resort to something besides gold in the majority of cases occurring posterior to the incisors. As to the latter, we should be ashamed of ourselves if we failed to save seven-eighths of them without resorting to filling at all. If we desire to avoid the necessity for the wholesale extraction of the natural teeth, and their substitution by artificial ones, let us recognize the plastics more largely in our practice.

Use always the materials which return the best results, irrespective of their cost or by whom made. Prepare every cavity as if it was to be filled with gold. Leave no fragile walls exposed to antagonizing forces, but protect with metal. Make obtuse angles on the grinding-surface walls, that the filling may present no sharp or thin edges to be broken away. Force it into each cavity with Japanese bibulous paper under the point of a plugger. When practicable, place a temporary matrix, made of gutta-percha, on the buccal and palatal walls, the object being to force the alloy into a denser mass and bring the mercury to the surface. This matrix can be easily held by the fingers. Its use will be found to be of vital importance to the perfection of the operation. Shape the filling with great care as it hardens. Wet cotton or paper is admirable for contouring the surfaces. A magnifying hand-glass is a *sine qua non*, and should be used in all cases. Carefully examine the occlusion of the teeth, to avoid any subsequent dislodgment of the mass. Many plastic fillings are rendered worthless by leaving them too full. During the hardening process go over them frequently with the burnisher. After the hardening process has been completed, thoroughly finish the margins with Scotch stone, and afterward with pumice and soft-rubber disk. Let a final inspection be made under a lens.

Discussion.

Dr. Darby.—I am sure that none of us feel like criticising disparagingly Dr. Bonwill's efforts to improve the character of amalgams. I know nothing of his preparations except what he has said about them. If he has made improvements in amalgam he is to be commended, and for one I should not take exception to his course in keeping from the society the secret of his composition. I am in the habit of using Holmes' Star Amalgam No. 2. It gives me good sharp edges and retains its color as well as any I have used. I have long since observed that, when an amalgam filling touches a gold one in the same tooth, the margins of the amalgam filling are always better, although there is great discoloration of the amalgam. Just what chemical change is produced by this union I am unable to state, but so thoroughly am I convinced that it is good practice to let amalgam and gold touch in the same tooth that I do it wherever I can. I do not consider it bad practice to put them in the same cavity, and where the discoloration is not a serious objection I should advocate that treatment for large and difficult cavities.

Dr. Buckingham.—Amalgam will do for operative dentistry what rubber has done for mechanical. It will depress it to just as low a level. One dentist wants an amalgam white, another wants it black; and, although experience has shown that it does not shrink, yet it does blacken the teeth most wretchedly. The oxidation of an amalgam may preserve the teeth; but then look at the condition of the mouth! We all like to have things look nice. Ladies wear gold jewelry because it presents a better appearance than if made of inferior metals, and gold looks much better in the mouth than amalgam. The addition of gold to an amalgam will not protect it from discoloration. If used at all, it should be used judiciously.

Dr. James Truman.—I am satisfied from my experience in its use that amalgam has valuable qualities. I cannot indorse the broad statement that it discolors to the extent of making the teeth black. It is evident that the cause of this when present arises from bad manipulation. There is great negligence in performing the final work in such fillings, and they are left with scarcely an attempt at finishing. The same carelessness with gold or any other material would result disastrously. With a high finish the retention of secretions at the margins would be avoided. This, in my judgment, is the principal cause of the discoloration complained of. If the same care is taken with this material that we give to gold and it is used judiciously, there need be no fear that the status of the profession will be lowered by its use.

Dr. H. C. Register then read a paper on "The Action of

and Reaction upon Fillings." He considered the filling of a vitalized tooth as a purely surgical operation, but not so of one devitalized. If the object is merely to fill up a cavity just as it would be done in any hard, inanimate substance, then the operation is purely mechanical. But in a live tooth the primary object is the removal of such diseased portions as have passed beyond recuperation, and to afford an artificial protection adapted to the individual tooth-structure. The reaction upon the foreign material introduced results in a secondary tissue compatible with the changed condition of the organ. He argued that dentine has the power of protecting itself after being divested of its enamel, illustrations of which fact may be seen in the mouths of our elderly patients between whose teeth crude separations were made many years ago. The same fact is apparent in cases treated by Dr. Arthur's system of separating. He did not refer to these cases to indorse the practice,—on the contrary, he thinks it very pernicious unless great care and judgment be used—but to call attention to the power of recuperation existing in tooth-tissue which has been deprived of its natural protective covering. Such tissue when denuded will not remain in contact with foreign matter for any great length of time without either a physiological or pathological change taking place. The character of the change will depend upon the individual structure of the tooth, the selection of filling-material, and its adaptation to the dentine wall with or without mechanical injury. Remove from a cavity the diseased portions, consisting chiefly of basis-substance from which the lime-salts have disappeared, fibrils in various stages of inflammation, intersected with fungi, and loaded with bacteria; prepare and fill the cavity. The open-mouthed tubes surrounding the filling—numbered by thousands—contain organic matter liable to inflammatory action, and a nervous reticulum susceptible to the most exquisite pain. That this condition should remain unchanged seemed to the essayist most unreasonable. From the fact that foreign bodies, such as bullets, will, under favorable conditions, become encysted in muscular tissue, he argued that the same law was at work in restoring exposed dentine to an approximately normal condition by a deposit of secondary material, and that such deposit may be stimulated by the presence and contact of the proper filling. He insisted that to bring about this result the age, temperament, and constitutional condition of the patient, and the character of the tooth-structure, must be observed, and a suitable filling-material for the individual case adopted. A tooth which has reached the stage of perfect calcification can be saved from progressive caries with but trifling labor, because of its inherent ability to resist or overcome local irritation. But at an earlier stage of tooth-life, or later, under peculiar systemic influences, operations,

to succeed, must assist nature until she has built up barriers to counteract thermal influences, and must also prevent the admission of decalcifying agents.

Some time ago Dr. D. D. Smith reported some interesting observations in regard to the combination of gold and tin as a filling-material, supplementing observations of a like character made by Dr. F. P. Abbot, of Berlin. Dr. Register had pursued this practice for more than twelve years, adopting it in the early part of his professional life in order to bring his operations within the means of his rural patients. Noticing, however, that tin would disintegrate in the course of years, he had substituted amalgam, and with unvarying good results. He attributed this uniform success to his observance of several rules: First, never to use cohesive gold until the enamel line is reached, and then only when approaching or on grinding or incising-surfaces. He makes the combination at the same sitting, unless electing to build out the amalgam in contour, leaving it platformed for a gold finish at a subsequent sitting. The cases which he thought demanded this course of treatment are those in which the cervical margins are likely to retain food debris and mucous secretions. He claimed to have had marked success by such treatment after repeated failures by ordinary methods. In applying the amalgam he makes it as dry as possible, and mallets it into position by light taps, the cavity having been previously slightly dove-tailed; he does not believe in retaining-pits. Soft-gold cylinders are then to be placed in the cavity with their ends projecting as far beyond the desired contour as is necessary in order to make a thoroughly-condensed surface. Care should be taken to keep a cylinder under the point of the instrument, and as the masticating surface is approached the foil can be annealed and made as hard as desired to the full depth of the enamel. He has little doubt that amalgam so treated is impacted not only directly upon but into the tubuli, pushing back the animal matter. The amalgam in conjunction with the gold makes a non-shrinking filling, and retains a perfect edge. He considered that such a filling exerted a therapeutical influence upon tooth-structure, causing a deposit of lime-salts.

Dr. Darby.—I fill most pulp-chambers with oxychloride of zinc, and consider it the best material for the purpose. I do not remember to have ever removed a gold filling from a pulp-chamber and root-canal that there was not a disagreeable odor arising from the decomposition of the once living matter contained in the dentinal tubuli. The antiseptic properties of the chloride of zinc when used prevent this, and if the oxychloride is used thin enough the mouths of these tubes are filled with it. No filling of gold would so thoroughly occupy the pulp-chamber and root-canal. It has many advantages

over gold and so far as I am aware no disadvantages. I do not remember to have filled a root-canal with gold in eight years.

Dr. Leech.—I present a crown of a tooth removed from a child four years old, apparently in good health. It looks like an exfoliated permanent bicuspid. The teeth adjacent to the point of exfoliation were in a healthy condition. What was the probable cause of its being thrown off?

Dr. Darby.—It is a developing bicuspid.

Dr. E. R. Pettit presented a specimen of the perfect union of the central and lateral incisors of the temporary set. The same condition existed on both sides, and the child's sister's teeth were also united in exactly the same manner. The permanent teeth are coming in properly. He also exhibited a model showing the perfect union of the temporary lateral incisor with a supplemental lateral incisor; another showing the presence of four lateral incisors in the mouth of a child two years of age. The two supplemental incisors had come in about fifteen months after the other laterals made their appearance.

The regular meeting was held Saturday evening, February 4, 1882, at the office of Dr. C. J. Essig, 1533 Locust Street. A paper was read entitled

ASSIMILATION OF INORGANIC PARTICLES—TOPICAL ACTION OF MINERAL WATERS.

BY JAMES TRUMAN, D.D.S.

When the possible pathological relations that may exist between the food we eat, the water we drink, and the air we breathe, are taken into consideration, the importance of these, in a hygienic sense, has not been over-estimated. That they have claimed and are continually claiming more and more the attention of intelligent medical men is creditable to that growing feeling that prevention is better than cure in disease, and that the study of the laws governing all the relations of life, with its surroundings, is of more importance than the discovery of remedies to counteract injurious effects.

It requires but a cursory glance at the history of the world, written in its geological records, to reach the conclusion that the elements of life have undergone and are constantly undergoing change, and in proportion as this is effected, just to that degree will vegetable and animal life present variations. That this must be toward refinement is evident.

While it develops new forms it makes new conditions, and these, in their turn, act beneficially or otherwise in proportion to their character. The records of vegetable life left us from the carboniferous era exhibit elements of grossness that must have pervaded all surrounding life. Animal creations superinduced and developed from the coarse vegetable growths assumed characters consistent with the elements of nutrition so remarkably distributed at this period. Judging from what we know of earlier epochs we are justified in the conclusion, that as the cooling process of the world's surface was perfected, and the surface roughly broken by the action of floods and the grinding processes of the glacial period, the detritus left was necessarily combined with elements that bear no proportion to those existing at the present era. While the primary formations give us no evidence of this condition of things, the later period, the carboniferous solves the problem; and reasoning from the data furnished by the coal-formations, we can read the past clearly, and with a certain prescience can anticipate the future. Whatever may be thought of the theory of evolution, this much seems to me demonstrated, that no vegetable, no animal, no world was ever created perfect, as we understand it, nor can it be said that perfection exists in all these relations at the present period. Change has gone on year by year, century by century, developing with and in conformity to the variations of the elements combined with the inorganic substances. These, in their turn, by the known laws of assimilation through vegetable to animal tissue have advanced all life to the present hour. As there can be no alteration in the laws of progressive development, the future opens up a wide field for the theorist, in which an era is plainly visible when the earth and all growths will have become so thoroughly refined that our present condition will seem grossness compared with it. That the fabled millenium has some foundation in fact would appear evident, so far as physical development is concerned; and if there is a physical there must be a corresponding mental growth which in eons of time will lead humanity nearer the great central source of all life, the intangible but infinite power of the universe.

While the future of this world is an enticing theme to theorists and dreamers; while the poet may have visions of Arcadian bliss, and the theologian anticipate the period when this sin-laden world will return to the paradisial state of the original father and mother of the race, we are more directly interested in observing the effect of these varied conditions in the production of organs and the building of systems.

It requires but a cursory glance at the flora and fauna of the prehistoric period to be convinced that assimilation proceeded with a result proportionate to the conditions then existing; or, in other

words, animal life was coarse because vegetable life was coarse; and vegetable life was coarse because certain elements were contained in greater proportion in the earth and atmosphere. When we examine existing conditions of things on the earth's surface, this idea of the past is strictly borne out. The interior of Africa is covered with a population that appears to vary just in proportion to the cultivation of the soil. In some sections the grossness of human life bears a strict relation to the grossness of the flora; in others the refinement is the natural result of previous conditions. The world's progress is based principally on its food. Egypt advanced over all other portions of Africa because of the fertility of the soil, and, this being taken advantage of, the improved cultivation refined the vegetable forms; they in an equal ratio developed the animal, the animal the spiritual life of this people, until it stood at the head of all ancient civilization. When we examine another portion of the earth's surface, Australia, we find the aboriginal condition very peculiar. The flora and fauna are measurably unlike those of any other country, and link it in a marked degree to a much earlier period of the world's history. Animals of the marsupialian type exist there in a proportion that has no counterpart in any other land. Indeed, this is the habitat of the only link that connects the animal with the bird—the ornithorhynchus, the duck-billed marsupial; the whole type is indicative of an earlier era. The natural result, and one to be looked for, is a low order of men, the lowest, perhaps, existing on the surface of the globe. I might prolong this analysis through all the various races of men—the low intellectual grade of the Esquimaux fed on blubber; the savage and merciless disposition of the North American Indian fed on an almost purely flesh diet; the evidences of retrogression in the aborigines of Central America, advancing by the cultivation of a productive soil to a high degree of civilization, and returning to the original type of barbarism as the flora was neglected.

The idea I wish to impress is that assimilation and nutrition are clearly progressive and cannot be forced into unnatural channels. The laws of growth have yet to be written. The differences between the protoplasmic elements that originate a tooth and those which originate bone may not be capable of analyzation by the microscope, yet we know there is a force that directs to formation more unerringly than the compass to the magnetic pole; and while Tyndall may quibble over the fact that science stops at this point, the intelligent observer knows that life formations are governed by a power that cannot be weighed, analyzed, or formulated by science, and yet they are demonstrated by their existence. The process of assimilation partakes somewhat of the same character. We cannot define the why and the

wherefore of certain effects, but we know they exist and can draw satisfactory deductions from that knowledge. If the elements that existed in the atmosphere, in the soil, in the flora, produced a fauna of extreme coarseness in an early period of the world's history, and if at all periods this proportion to condition has existed, we infer the law: *That the inorganic elements necessary for the nutrition of higher forms must first be elaborated in the lower.*

If this law be formulated on a basis of correct inductive reasoning, what does it imply and how does it interest us as special workers on tooth-structure? It necessitates a more thorough study of the elements composing every portion of our own organizations. It plainly tells us that we must throw around every individual the best food, the purest air, the most vigorous life attainable, if we would refine and elevate our race. It proves that there can be no assimilation, and consequently no nutrition of inorganic particles presented to the human organism for the purpose of adding strength to certain organs, as the teeth in our specialty. It demonstrates the incorrectness of the idea that lime in solution is the proper way to feed structure, and finally it clearly points to the only true route, that of nutrition through inferior organisms.

The proportion of the inorganic substances we all know varies in dentures, and their absence in certain structures has been and still remains the cause of much anxiety and difficult manipulation in our profession. I do not propose to discuss the remedy, if such exists, in this essay, as that has already been done by others, but as I remarked in a paper previously read before this association, the improvement must come through changes in soil, climate, and food.

If the process we call nutrition could be carried on by assimilation of inorganic elements, then the question of food would be comparatively a simple one, and instead of the growth of cereals and the driving of animals to slaughter, we would have the chemist busy in his laboratory, and the production of artificial food would become one of the varied industries of the world.

When the lower orders are examined we do not find an assimilation of inorganic particles, or, if such does exist, it is out of all proportion to the amount taken into the stomach. The evidence, if any existed, would be found in far denser dental organs, but this I have failed to observe.

The lower order that lives on a mixed food—vegetable growths and crustacea—as, for instance, the sparoids, ought to illustrate this in a marked degree, but with the exception of increased density of the pavement teeth there is no marked variation from the normal standard, and even this I think can be demonstrated to be the result of

the interlacing of the fibers of enamel rather than from any absolute increase of density.

The fact that hens must be fed occasionally on lime in order that shells may be formed cannot be regarded as adding any strength to the argument in favor of lime-assimilation. The shells of eggs cannot be held in any sense as organized products, and hence they bear no more relation to the hard tissues of the animal organization than a calcareous deposit in the mouth resembles the tooth upon which it is deposited.

That increased density can be affected by the presentation of food containing the necessary elements there can be no question, but that it can ever be accomplished by direct administration of the inorganic I hold to be impossible. Careful observation through a series of years in lime-water districts leads to the conclusion that assimilation cannot be carried on in this way, and that it is a waste of energy to attempt it. What changes the inorganic elements undergo through the process of absorption and assimilation by the vegetable is a chemical problem yet unsolved; but that there is a change is evident from the results observed.

If the positions taken are accepted, they lead to the natural inference that the action of water as an element in the process of nutrition has not the influence ascribed to it. That it is the most convenient means to present certain substances capable of being held in solution is conceded, but that these, so held, are converted into solid tissue cannot be admitted by the writer. That water is an important factor in nutrition is accepted without question. That in one sense it is food, and is as essential in building up structure as more solid aliments, needs no argument, but that its facility in holding substances in solution is any aid to assimilation and nutrition must be regarded as an untenable theory.

The limits of this essay will not permit me to follow the physiological effects of water; these are well understood, and it would be simply an iteration of known laws to repeat them here. I shall, therefore, confine myself solely to the possible destructive action of water on tooth-structure, an action directly opposite to that of nutrition.

The extensive use of water makes it desirable for us, as dentists, to know how far it operates for good or ill in relation to teeth. I have already attempted to show that assimilation does not proceed through this channel, and if this position be conceded to be correct, it may be broadly asserted that water has only an indirect influence in the formation of tissue, and is not food in the strict sense of that term. Its therapeutic value is unquestionable, but that I do not propose here to consider. Its universal use, however, makes its local influence of very great

importance, concerning, as it does, a very large proportion of the civilized world, and hence I have felt it of sufficient interest to give it more than ordinary attention, and to consider it as a proper companion-subject to that just discussed.

When it is remembered that the waters of the earth hold in solution many of the minerals, it is rather singular that so little attention has been given to the subject. The so-called mineral waters of this country and Europe have been celebrated for peculiar therapeutic properties, each spring having a distinct value in proportion as it contained certain determined ingredients in solution.

In Europe the drinking of these waters has been reduced to a system, and, as a branch of medical treatment, has assumed proportions so remarkable as to render it worthy of a special paper. The influence of Carlsbad, Ems, Wiesbaden, Pyrmont, etc., is not confined to the localities named, but is world-wide in its extent. The effect is visible in every town and hamlet in Germany. To those who cannot go to the springs the springs are brought, and the long lines of pedestrians starting in the early morning hours, in every German city, for their drink of Carlsbad, etc., is proof of the fact, that at least they have faith in the curative properties of the fluid they despise so much as an ordinary drink.

The consideration of this fact, and of the necessary or possible pathological influence on tooth-structure, induced the American Dental Association of Europe, to appoint, in 1876, the author of this paper to investigate it. During that and the following year, this investigation was in part completed, and the results were given to that association in 1877.

As germane to the subject under consideration, I make extensive quotations.*

The specimens to be submitted to the action of the waters were carefully prepared; the bottles tightly corked, and then left for several months. Examinations were made at variable intervals, and a final one given under a low power of the microscope. Other means were also resorted to to mark any action that might have taken place. The results were as follows:

"*Carlsbad Muhl*" gave a very marked alkaline reaction. The tooth submitted exhibited not the slightest trace of injurious effects, the enamel and dentine presenting the same dense polished surface at

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*The report from which these extracts are taken was withheld from publication on account of its incomplete character; the author desiring to embrace in his investigations a larger field. Circumstances not favoring this, they are here given as originally written.

the close as when first placed in the vial. The largest component part of this water by analysis is sulphate of soda. The next in amount is bicarbonate of soda, followed by chloride of sodium, carbonate of lime, with varying quantities of carbonate of magnesia, iron, protoxide of manganese, etc. This would give an alkaline reaction. In order to test whether the influence of the alkaline fluid had extended to the organic tissue of the tooth, it was submitted, finally, to the action of hydrochloric acid. The result was that not the slightest effect was visible. The cementum and dentine exhibited no loss of substance. As neither the inorganic nor organic elements had been affected, it was decided that positive alkaline waters had no direct injurious effect on any of the tissues of the teeth.

"*Emser Kranches.*" This is one of the wells of Ems. Analysis gives the largest amount in the bicarbonate of soda, followed in lesser amounts by chloride of sodium, carbonate of lime, carbonate of magnesia, iron, manganese, sulphate of potash, etc.

This also gave a marked alkaline reaction. Microscopical examination failed to show any peripheral loss. The margins of a small filling intentionally left in the specimen were perfectly preserved.

"*Das Kissinger Bitterwasser.*" The bitter water of Kissengen. The analysis gave sulphate of soda, sulphate of magnesia, sulphate of lime, chloride of magnesium, chloride of sodium, etc.

The reaction of this water was decidedly alkaline, and the same absence of injurious effects was noticed here as in the others mentioned.

"*Kreuznacher Elisabeth.*" The wells of Kreuznach. Analysis yields the largest amount in chloride of soda, chloride of lime, carbonate of lime, chloride of magnesia, carbonate of magnesia, iron, phosphate of magnesia, etc. The reaction was alkaline, with no trace of injurious action.

"*Schwalbach Stahl.*" Steel waters of Schwalbach. The analysis gives bicarbonate of soda, carbonate of lime, carbonate of iron, protoxide of manganese, silicic acid, chloride of lime, sulphate of potash, etc. The reaction here was neutral when the water was first placed in the vial, but subsequently assumed an acid character. The action on the tooth was not very marked. The enamel was not perceptibly affected, and there was but a very slight removal of inorganic particles from the cementum.

It was very evident that a chemical change had taken place subsequent to immersion. This was undoubted caused by the penetration of air. As this is evidently not its normal character, judgment passed on the result must be falacious. My opinion is that taken in its natural state it would not be injurious.

"*Driburger Stahl.*" Carbonic acid gas in large proportions; protoxide of iron, protoxide of manganese, carbonate of ammonia, carbonate of magnesia, sulphate of soda, sulphate of potash, chloride of soda, lithium, etc. Reaction slightly alkaline. Subsequently a chemical change took place, and an acid reaction was manifested. The cemental tissue was slightly acted upon. No action preceptible on enamel.

"*Aachener Thermal.*" Analysis: Chloride of soda, sulphate of soda, sulphate of potash, carbonate of soda, carbonate of magnesia, protoxide of iron, strontia, silicic acid, etc. Reaction slightly alkaline. In a few weeks there was a change from the almost neutral condition of the first period to that of a slight acid reaction. The effect on the specimen was not of marked character, but sufficient to show its injurious influence.

"*Pyrophosphor Saures, Eisenwasser.*" Knowing that much of the water drunk was manufactured, I included this in the examination. The reaction was neutral at the first testing. A subsequent test gave a strongly acid character, much greater than any of the others subjected to this chemical alteration. The consequence was very great destruction of the inorganic elements. It is possible that this compound might be injurious to tooth-structure in the normal condition of the water. Further examination will be needed to decide this point.

"*Pyrmonter Stahlbrunnen.*" Alkaline reaction. No evidence of any action on tooth-structure.

"*Pyrmonter Salz.*" Alkaline reaction. No action on tooth.

"*Wildunger-Georg-Victorguelle.*" Alkaline reaction at the first testing. An examination four weeks subsequent to immersion, gave a slight acid reaction. The final result was some loss of substance in the cemental tissue.

"*Homburg Elisabethguelle.*" Reaction slightly alkaline at first examination. A change subsequently took place, and it assumed acid qualities. The destruction in the root of this specimen was greater than from any of the other natural waters.

"*Berliner Sauerbrunnen.*" The test here gave an alkaline reaction. No marked effect on tooth-structure at any period subsequent to immersion.

An examination of these details, imperfect as I know them to be, gives some results that are of interest. In all the waters possessing a strictly alkaline character, there was no action upon the tissues, nor was there any change in the water. They gave the same reaction throughout the period of observation. In those of neutral character change invariably took place, resulting in a more or less decided acid

reaction. In proportion to the amount of acid were the tissues affected; this was most perceptible in the manufactured article.

In order to test the correctness of the often repeated theory, that all alkalines are intensely destructive to the organic portions of tooth-tissue, it will be observed that a tooth immersed in the strongly alkaline waters of Carlsbad was further subjected to treatment with hydrochloric acid. This, of course, removed all the inorganic elements, and would show the loss in the organic if any existed. The result proved very conclusively that there had been no action on this portion of the structure, and as there had not been the slightest previous effect on the inorganic elements, the conclusion was inevitable that alkaline solutions had no effect on these tissues. This result is confirmatory of experiments made years previous.

It must be borne in mind in judging of the effect of fluids on dead teeth, that devitalization predisposes to destruction. The power to resist injurious influences is lost in proportion to lack of vitality. So that while a tooth might easily be affected by destructive solutions out of the mouth, it might not be injured in the least when in normal position by the presentation of a much stronger acid. The counteracting elements exist in the alkaline saliva and in the vitality of the organ. In a mouth with the secretions normal, a slightly acid fluid would have no effect, but, on the other hand, were these abnormal, that is, giving an acid reaction, the destructive force would be multiplied.

It must be borne in mind that pathological conditions are frequently the primal cause of the great destruction in teeth. The equilibrium has been disturbed to the extent of an entire change in the oral secretions; unless these can be altered locally or systemically, there will be a continuous destruction manifested. Before arriving at any conclusion, whether a special case was or was not affected by the action of the water, the previous condition of the oral secretions should have been ascertained.

A result brought out in this investigation, while by no means new, recalls the fact that nearly all the tests made of oral secretions give a neutral response, and the investigation shows that neutral solutions change rapidly to acid. It seems to the writer that this furnishes the key to the problem that has surrounded and still surrounds the great destruction of tooth-tissue. A few hours' rest will effect an entire change. This may be produced in any depressions or between teeth, or the entire series may be acted upon during sleep, and this is the period of greatest destruction. The whole question might profitably be considered here, whether some simple means could not be resorted

to to counteract this effect, but that is not included in the scope of this paper, and is merely alluded to as of suggestive interest.

The inference to be arrived at from the examinations here given, is that there is no local destructive action by the ordinary waters that are found upon the earth's surface.

The regular meeting was held Saturday evening, March 4, 1882, at the office of Dr. Daniel Neall, President Dixon in the chair.

Dr. E. R. Pettit exhibited models of a case of irregularity both before and after correction. The irregularity consisted principally in a very great (inherited) prominence of the upper front teeth. After correcting this and retaining the teeth in position for some months they had returned to their former position soon after the apparatus was removed. He inquired as to the probability of ever retaining them in proper position without the constant wearing of a retaining apparatus, as the tendency to return seems greater in cases of this character than in any other.

Dr. Darby.—I should make a rubber plate to fit the roof of the mouth, capping also the molars, and let a band of rubber pass around the labial surfaces of the front teeth, thus holding them firmly in position. This I would have the patient wear at least a year, or until I was satisfied that new bone had been formed.

Dr. Jas. Truman's paper, entitled "Assimilation of Inorganic Particles—Topical Action of Mineral Waters," read at the last meeting was then discussed.

Dr. Buckingham.—This paper requires, for proper discussion, a great deal of consideration and preparation. There is one thing I cannot clearly understand, and that is, what causes the acid reaction of the neutral solution and the changes of mineral or inorganic matter into organic. We have the Tyndall and Pasteur theories on the cause of life, besides the materialists' views. Inorganic substances taken into the system must be in solution that nutrition may be obtained from them.

Dr. D. Neall.—Civilization, with its inevitable concomitants of luxury, etc., has led to inherited weakness of tooth-structure. It has also taught us the use of agencies to resist such encroachments. Among these primarily is every-day systematic cleanliness, the removal by the simple means at every one's hands of these accretions which assist most assuredly and powerfully by chemical change in the decay of tooth-substance.

Dr. Jas. Truman.—I do not regard the administration of combinations of inorganic materials to be of any value in the nutrition of tooth-tissue. To make them of value they must first be presented in the form given us by lower organisms, and from these natural selections will follow suitable to each organ. Observations in lime-water districts lead positively to the conclusion that the water thus impregnated is utterly valueless, if, indeed, it does not have a decidedly injurious influence. In answer to Dr. Buckingham, I hold that the greatest change in the oral secretions from a neutral to an acid condition is at night or during periods of rest.

Dr. Darby.—I have been greatly interested in Dr. Truman's paper, and can confirm what he has said with reference to the character of the teeth of those who inhabit lime-stone regions and where the water is largely impregnated with lime. It is undoubtedly good practice to rinse the mouth with lime-water, and the use of prepared chalk is also good as a precautionary measure, neutralizing, as it must, the acidity of the mouth, but whatever of the lime-salts enter into the teeth must be introduced through the system in the form of food. I am heartily in sympathy with the effort which is being put forth by parents and others to feed children largely upon those articles of food which contain the phosphates in greatest abundance. I am not prepared to say that the effect of such food would be apparent in a single generation, but it is my firm conviction that the effect would tell beneficially in a few generations, and certainly those articles which contain the phosphates in large quantities are nutritious and pleasing to the taste.

Dr. Jas. Truman presented for inspection two condensing burnishers to be used with the hand-mallet in the distal surfaces of posterior teeth. They were sent to him by Dr. Jenkins, of Dresden, Germany, who had devised them for this purpose and used them with great satisfaction. They are most conveniently used when an assistant is employed to do the malleting.

The regular meeting was held Saturday evening, April 1, 1882, at the residence of Dr. E. H. Neall, Dr. Truman in the chair.

INCIDENTS OF PRACTICE.

Dr. Register.—I brought out a lateral incisor nearly half an inch in just one week for a miss thirteen years old. I saw her but once; she turned the jack-screw herself, and no pain nor inflammation followed. I think it a mistake, however, to push teeth too rapidly, if

the tissues are at all hard. To avoid cutting a cavity in the palatal portion of a tooth, at the suggestion of Dr. Kirk, I placed a very thin band of platinum around the tooth, and filled against it and the palatal wall with amalgam; I made a depression in this and adjusted the point of the jack-screw.

Dr. Guilford.—In regulating teeth, that is, in bringing them from an abnormal into a normal position in the arch, several things have to be taken into consideration. First, we must devise an appliance that will be effective; second, it must be constructed as simply as possible; third, it must do its work as quickly as possible, consistent with the existing circumstances; fourth, it should give as little pain as possible; and, lastly, it must be fixed in its position, and not liable to slip and cause injury and possibly defeat its object. Some of these considerations are too frequently overlooked by many who undertake this difficult class of work. There have been many systems, so-called, for the correction of irregularities, but no one of them contains all that is good or all that we need. The successful practitioner in this line is he who takes from each "system" that which will best serve his purpose, and then uses this with discretion. We sometimes see appliances for regulating illustrated and recommended in our journals that would require a master mechanic to construct and a skilled engineer to run. The idea also of moving teeth only on exact mathematical distance in each twenty-four hours is a fallacy. What we want is to use appliances not too powerful, and then push our work along as rapidly as possible, having regard, of course, to the age and health of patient and the surrounding conditions. Much harm has been done in years past by the slipping of appliances and the consequent wounding or injury of the soft tissues. The pain that is usually attributed to the moving of the teeth too rapidly I have satisfied myself is due to the rubber band, or ligature, or plate, or appliance impinging upon the gum. To avoid this, I have for the past ten years adopted a plan of keeping all my fixtures from touching the soft parts. I simply make bands or rings of platinum plate, and slip one over the tooth to be moved and the other over the one that I want to use as my fixed point of resistance. To these have been previously soldered either pins, hooks, or bars, as the case may be. The bands are lined with phosphate of zinc and slipped over their respective teeth to a point about midway between the cutting-edge and neck. Being kept dry for five minutes to harden, they will afterward resist all the force we may apply to them without becoming loosened. Out of scores that I have applied in this way, none that were properly placed have ever become loosened, though force has been applied to them for months continuously. If we wish to use a jack-screw as our power, instead of a

rubber band or bar, we need only solder stays or abutments to these bands at proper places and countersink them to receive the ends of the jack-screw. By their use we will have no slipping of fixtures, no impinging upon gum, and hence the very least amount of pain. In a couple of cases recently treated in this way, in each of which a central incisor was moved the width of its crown, and moved, too, as rapidly as double rubber rings would move it, occupying about a month's time in each instance, both patients have declared to me time and again that they suffered absolutely no pain.

Dr. Register.—The only advantage in using the oxychloride instead of amalgam is that it sets quicker. I should prefer the oxyphosphate to it, however, as it is harder. In regard to teeth not hurting when bands and ligatures are kept free from the gums, I think Dr. Guilford is mistaken; irritation of the peridental membrane will result in any case if tissue and movement are not made to harmonize.

Dr. E. H. Neall.—Two years ago I gave the society my method of making hard-rubber and corundum disks and points, and stated that I had used them with a great deal of satisfaction. Since that time I have had them in daily use, and these that I show you this evening have done considerable work, and yet show little signs of wear. While these disks do not cut tooth-bone as rapidly as corundum disks, yet they do cut and leave a polished surface; they are invaluable as trimmers and polishers of gold fillings. Another advantage is that they can be made very thin and will bear quite rough handling without chipping or breaking. So far as I know, these disks are not to be had at any of the depots, although I understand that The S. S. White Dental Manufacturing Company are experimenting in that direction, and expect to have them in the market at an early date.

Dr. Register.—I take black or red rubber and heat over a sand-bath made in a small glue-pot; great care must be exercised not to cook the rubber. The same result can be obtained by boiling in oil and rubbing into the rubber as much corundum or emery as possible.

Dr. Bonwill.—As to the originality of mixing corundum and rubber by heat for making files, wheels, etc., I did it as far back as 1861 and 1862 for cutting down gold fillings and smoothing enamel. I would not speak of this, but it is well to keep history correct, even if it has to be repeated. To incorporate the material thoroughly and in proper quantity very heavy machinery must be used and the heat kept very uniform. Small quantities can be mixed by hand, but it hardly pays. For my own use since 1872 I have had it made in quantity by machinery.

The regular meeting was held at the office of Dr. E. T. Darby, 1513 Walnut Street, on Saturday evening, May 6th, 1882, President Dixon in the chair.

INCIDENTS OF PRACTICE.

Dr. E. R. Pettit.—I am now treating a somewhat stubborn case, upon which I would like to obtain the views of those present as to the best mode of treatment and the prognosis.

The patient—a girl about twelve years of age—fell about three or four years ago and broke off the cutting edge of the right central incisor, and, judging from what the mother says, the tooth must also have been driven up into the jaw to some slight extent. The pulp was destroyed by this accident. The case appears to have been very judiciously treated by another dentist at the time, except, in my judgment, in one particular, namely, that after the restoration of the parts to a healthy condition, instead of the root being filled with some non-absorbent material, it was filled with cotton saturated, I suppose, with creosote, although there was no odor of creosote when I removed the cotton. As the dentist who then had charge of the case is a man of unusually good judgment in such cases, and in his practice generally, I cannot account for this treatment on any other grounds than that the patient would return to him in a short time, as she had been in the habit of doing regularly, when he expected probably to fill the root permanently. The patient, however, happened to come under my care shortly afterwards, and not knowing that there was cotton in the root of this tooth, and the tooth itself being comfortable, I did not disturb it. Recently, however, the parents became somewhat anxious about the tooth, as they thought it was growing darker, so they called my attention to it, and informed me for the first time that the root had been filled with cotton; I therefore removed the gutta percha filling and the cotton from the root, noticing, as mentioned, no odor of creosote, but at the extreme end of the cotton there was a drop of pus. There has been more or less discharge of pus from the cavity ever since, now about a month, as was to be expected upon re-exposure to the atmosphere, although I have no doubt if the cotton had not been disturbed trouble would have soon appeared, as indicated by the presence of pus on the cotton, and most likely with still more unfavorable results, on account of the retention for a time of the decomposing and irritating substances. There has been only slight soreness in the tooth. I have treated it with eucalyptus oil, carbolic acid, chloride of zinc and phenol sodique, in varying dilutions, and according to the circumstances at the time, but so far with but little beneficial result; hoping for the formation of healthy granulations beyond the root,

where there appears to be quite a cavity, and the gradual subsidence and ultimate cessation of the discharge of pus; or, in other words, for a restoration to such a healthy condition as would enable me to fill the root and crown permanently, that it might be retained as it is, or after a time be replaced with a pivot tooth.

Dr. Register.—In such cases, when I have any trouble after deodorizing and disinfecting, and there is soreness, I resort to blood-letting by leeches.

Dr. C. J. Essig.—In such cases I fill the canal at the apex with a small cylinder of gold to close the opening, and then fill the rest with oxychloride of zinc.

Dr. James Truman.—In chronic cases of pericementitis, I have found nothing so valuable as treatment by oxychloride of zinc. So valuable do I regard this that it has almost entirely supplemented other modes of treatment in cases following the removal of decomposed pulps. The first effect is an increase of pain, which soon subsides, with a rapid return to normal condition. The plan adopted is to mix the chloride with the oxide in a very thin paste, saturating a few fibres of cotton or floss silk with it, and pass into the canal or canals very loosely, and fill the crown cavity temporarily. At a subsequent sitting the canal or canals can be filled permanently if all inflammatory symptoms have subsided, which usually is the case. The permanent filling is the same, except that the fibres are saturated with a thicker mixture of the oxychloride and are packed solidly in the canals. This process I regard as far superior to gold, abandoned by me several years ago, as it is equally efficient as a stopping, while it possesses peculiar therapeutic properties specially indicated in the condition named.

Dr. Guilford.—When a devitalized tooth comes into my hands to be filled, and the root seems well filled and comfortable, and I know it to have been filled by a careful and competent operator, I do not disturb the root filling, but fill the crown right over it. Experience has taught me not to meddle with the root under such circumstances, but to "leave well enough alone."

In cases where there is an indolent suppurative condition at the end of the root, I try to bring it to a healthy condition by the use of mild remedies, such as iodine and carbolic acid or glycerine and carbolic acid, but where these fail to remove the trouble, and it proves to be persistent, I pursue a different course and treat it in a more heroic way. I inject (through the root,) either carbolic acid in its full strength, or chloride of zinc in half or two thirds strength. This will probably drive it into active suppuration, which I then treat in the usual way—first, with strong remedies until I have made an impression, and then toning down the treatment until I get to glycerine, with just a trace of carbolic acid in it.

This treatment bears some resemblance to that of the young physician who, with little skill or knowledge, excited the wonder of his neighboring colleagues by his remarkable success.

Upon being questioned as to his plan of treatment, he said that when called in to a case, no matter what it was, he always threw the patient into "fits" and then cured the "fits."

Dr. Tees.—For nearly twenty years I have filled pulp cavities in devitalized teeth with cotton saturated in creosote. I fill only the nerve canals of single-rooted teeth, using gold or platina wire, with a minute piece of cotton wound around the end saturated in creosote. In cases of any trouble this can easily be removed and relief afforded the patient.

Dr. Register.—In filling canals I generally use gold rolled into wire, saturated in a thin mixture of oxychloride. In old chronic cases, I discriminate sometimes in favor of cotton saturated in the same way.

Dr. E. R. Pettit.—Those who have spoken seem to have ignored entirely the presence of a cavity fully a half inch deep beyond the extremity of the root. It is this which renders the treatment difficult and the result doubtful. Without this, the treatment would be quite simple. My doubt is as to whether healthy granulations will ever form there so as to enable the tooth to be filled permanently. Bone will most likely never be re-formed there.

The regular meeting was held Saturday evening, June 10th, 1882, at the office of Dr. Guilford, 4006 Chestnut Street, President Essig in the chair. A paper was read, entitled

BURS IN THEIR RELATION TO PAIN.

BY S. H. GUILFORD, D.D.S.

The direction of surgical thought to the simplifying of complicated operations, to the rendering of them less protracted as well as more certain in their results, and to their being attended with less loss of vital power, and the conservation of pain both immediate and subsequent, has never been more marked than in the present portion of the nineteenth century. The outgrowth of this study has been the devising of such means for the accomplishment of these ends as the bloodless amputation, the anti-septic method of Lister, the Galvano-Faradic current, the electrical cautery, and last, though not least, the surgical engine. This latter is but beginning to awaken the attention and excite the interest to which its merit entitles it.

In our own profession, which is indeed but a branch of the great surgical tree, the same desire to simplify; to lessen pain; to make durable the results of our labor; to conserve the natural organs where often but the smallest vestige remains, has resulted in the introduction of mechanical appliances and therapeutical methods whose names or number it would be a work of supererogation to attempt to enumerate.

What these appliances and methods have done for us in later years is abundantly shown forth in the wonderful advancement made in the perfection and artistic beauty of the gold fillings of to-day, in the numerous additions that have been made to our store of plastic materials,—each one valuable in its proper place,—and in the improved methods of restoring to beauty and to usefulness the broken-down remains of what were formerly honored and useful members of the dental arch.

While our intensely practical American mind has given special attention to methods leading to the best practical results, it has not, we fear, given the attention it should to the conditions attending the attainment of these same results.

It is, unfortunately, our lot to be the innocent inflicters of a great deal of pain. To this we are not indifferent, as is sometimes supposed, but only too sensibly alive. The number of our associates who yearly "fall by the wayside," victims to the intense nervous strain and sympathetic accompaniment of our delicate work, abundantly proves this. It may be possible, however, that through our constant contact with suffering humanity we are not as much alive to the reality and intensity of the pain we are inflicting as we should be.

Much has been done of late years by the profession for the alleviation of pain in dental operations, and the amount that the patient is *required* to bear to-day is far less than it was a dozen years ago.

The discovery of the fact that thorough dryness of the part operated upon would greatly diminish its sensitiveness, and the introduction of numerous medicaments tending toward the same end, have been of inestimable benefit to both patient and operator, but there is still another element or factor in the production of pain, the elimination of which, could it be accomplished, would do much toward still further reducing the amount of suffering necessary to be borne in the process of excavating a cavity preparatory to filling.

It is the dental engine bur, in the proper manufacture and use of which, it seems to me, lies so great a power for comfort or discomfort to our patients.

This truth has impressed itself upon me from the fact of there being at the present time so great a variety of manufactures of the instrument in the market, and from my having had occasion to try many of them

with a view to testing their respective qualities. The difference in their wearing first impressed me, and after that the different effects they produced upon the patient while being used.

This naturally led me to a careful inspection of their points and cutting-edges under the microscope, with results which were somewhat surprising, and hence my determination to present to you to-night a *resume* of what I saw, and to show the same to you under the instrument.

Burs, in regard to the method of their manufacture, are of three kinds,—the hand-cut, the stoned, and the machine-cut. Of the two former, we have all kinds and qualities, depending upon the skill or honesty bestowed upon their manufacture. Of the latter, a recent introduction, we have but one quality, owing to the fact of there being as yet but one manufacture of them.

We have also a variety of the hand-cut bur known as the finishing-bur, but we do not propose to speak of it, as we are only considering burs in their relation to pain,—in other words, those used on the inside of the cavity.

According to the popular idea, the main qualities a bur should possess are well-cut teeth and proper temper. So far as the operator alone is concerned, this idea is, in the main, a correct one; but when we come to consider the matter from the patient's stand-point, it does not begin to cover the ground.

A bur may cut rapidly and well, and wear a very long time, and yet be very far from fulfilling the idea of a perfect instrument. To be such, it should both cut and wear well, and at the same time cause the least amount of pain in its use. To this end, other qualities are necessary. Notably, the bur should be true; that is, the center of the cutting-end should be on a direct line with the center of the shank. If the tool is not true, the point in its revolution will not describe a perfect circle, as it should, but, rather, an ellipse, by traveling in an eccentric way. The result of this would be that the head in its revolution, instead of touching the dentine all the while, as it should, would alternately touch and leave it, thus giving a series of raps or blows, producing very decided pain. The operator might not be conscious of this, but the patient would, although there would probably be ignorance as to the cause of it. This rapping or thumping of the tooth in the process of burring is, to my mind, one of the more prominent causes of pain in excavating.

This same effect is produced, though in a less degree, by irregularity in the height of the different teeth or cutting-edges of the bur. Again, the same result may be brought about, and often is, even where a most perfect bur is used, by operating it in a hand-piece that does not run

true. From this it appears that a bur should not only be well tempered and well cut, in order to save our time and expense, but that for the patient's sake it should be true, that the teeth should be of a uniform height, and that it should be operated in a hand-piece so accurately constructed as to carry a true bur in a true manner.

Another element in the production of pain, and certainly a most important one, is the evolution of heat by friction. This is usually produced either by the teeth of the bur being ragged and dull through improper manufacture, or by using a bur after it has become worn and dulled, or by keeping any bur in contact with the tooth too long at a time.

The first can be overcome by not pnrchasing or using a bur that is carelessly or improperly made. The second and third need only a little watchfulness and care on our part to avoid. We need but think to be convinced of the fact that a sharp cutting-tool, traveling at a velocity varying from five hundred to two thousand revolutions per minute, will cause less friction and hence produce less heat and pain than a dulled one or one improperly or poorly cut and sharpened.

In this respect a stoned bur (other things being equal) will be far superior to one where the scale of the final tempering has been allowed to remain on the cutting-edges to dull them or impede their progress through the resisting substance.

A dulled bur, no matter what its original make or cost, is the one that is most painful, and for the use of which there is the least excuse. The rounded edges, exposing a greater surface to the dentine in the revolution, and borne down upon by the operator in a vain attempt to make them take hold, generate heat in a very rapid manner, and cause pain in a corresponding degree.

Through inadvertence, I think we all at times use burs duller than we are aware of, and thus unwittingly cause pain.

One of the best ways to avoid this is to lay out a dozen or more new burs at the beginning of each week, and at its close lay them aside to be re-cut.

A bur that has been re-sharpened is, in the very nature of the case, a very imperfect one. Some of the teeth will have been broken or worn more than others, and, while the workman can sharpen them after a fashion, he cannot equalize the height of the teeth.

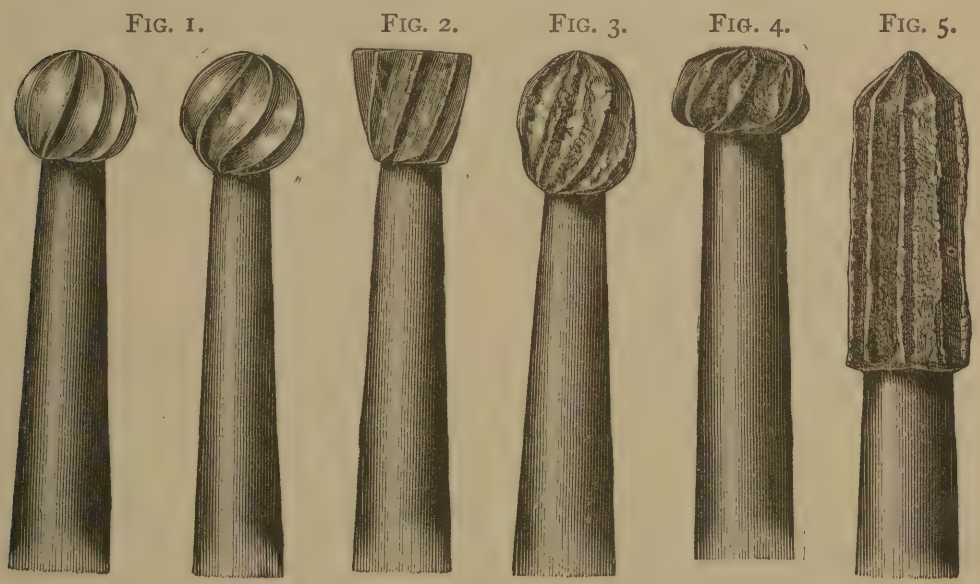
The machine-cut bur, owing to its manner of manufacture, is the poorest new bur ever introduced. The teeth are of unequal height, and so poorly cut that the edges resemble the teeth of a saw more than a cutting-instrument. It is, therefore, a very poor instrument to use upon a living tooth. Aside from its employment upon living dentine, however, it must be said, to its credit, that, as a rule, it possesses a

degree of hardness of cutting-edge that makes it, with the re-cut bur, a very useful and valuable instrument, indeed, for the opening-up of fissures or for excavating in devitalized teeth.

Another variety, known as the "honed" bur, just introduced by The S. S. White Dental Manufacturing Company, is of a grade between the "stoned" and the ordinary bur. The edges and sides of the teeth are carefully dressed and polished after tempering in such a way as to give it very much the appearance of the "stoned" bur, although it is much lower in price.

I have had no opportunity to test this variety, as I have not seen any of them before to-night, but, from an examination, I do not hesitate to say that I shall be surprised if they do not possess all the valuable qualities of the stoned bur.

In order to enable me to examine the accuracy of cut and finish of the bur-heads, I have arranged a small appliance and fitted it to the stage of the microscope in such a way as to bring the bur-head into the field of vision and there have it revolve, in order that the entire circumference may be in turn examined.



In examining the stoned bur (Fig. 1), you will notice the polished sides of the teeth and the clear and keen cutting-edges. Even the bottom of the furrows between the teeth is smooth and polished, enabling the bur thereby in the very best manner to clear itself in the act of cutting. This latter point is one not to be under-estimated, for when a bur is in a condition to favor the retention of the debris in the furrows, they soon fill up, and thus practically lessen the depth of the cutting-edges, and so far interfere with its usefulness.

The general appearance of the head of the stoned bur shows the care, skill, and labor necessary to its production.

In direct contrast to this most perfect of cutting-tools, I would have you notice the ordinary bur (Fig. 2). When this instrument is well made, the teeth will be of uniform height and shape, and it will be as perfect as the file can make it before tempering; but in the latter process, by the oxidizing of the metal, its entire surface is covered with scales, making it rough and irregular, where, before tempering, it was comparatively smooth. No doubt the file-marks, fine as they are, favor the retention of this scale upon the surface of the metal. You will perceive that not only are the furrows rough from this scale, but the cutting-edges are also made dull and uneven by it.

It is easy to decide as to the relative value of the two instruments.

In the re-cut bur (Fig. 3) you will notice its similarity to the new plain bur so far as roughness from scale is concerned. Its teeth, however, are of unequal length, caused by some of them having been previously broken and their being filed to an edge in their present shape. This fact makes it one degree worse than the ordinary bur as a pain-producer.

Next, I would call your attention to the worn bur (Fig. 4), and have you notice under the microscope what we cannot so perfectly discover with the naked eye,—its utter worthlessness as a cutting-tool.

Some of the teeth are broken, while others are worn down so as to more closely resemble a burnisher than a cutting-tool. These worn and smooth edges, together with the irregularity of the teeth, make it an instrument that, by heating and thumping the tooth, would cause more pain and do less work than any other.

In the machine-cut bur, (Fig. 5), which I show you last, you will notice, in addition to the scale, the general roughness, not only of the cutting-edge, but of every part of the furrow. All its surfaces present the appearance of having been coarsely draw-filed. This is no doubt due to the rough surface of the tool used in cutting them. You will also notice that pieces have been chipped or broken out of some of the cutting-edges. This is probably due to the hard temper of the bur and the lack of delicacy of the tool cutting it. Of the specimens I have just shown you, all are entirely new and have never been used, except, of course, the worn bur and the re-cut one. The latter has not been used since it last came from the instrument-maker's hands.

The specimens are from different makers, and have been bought at random from the general stock of each maker. There has been no careful selection in any case. In order to show the relative trueness of the various burs, Mr. Starr, at my request, has kindly brought with him an instrument devised by himself and admirably adapted to the purpose. By it you can see at a glance which burs are true and which are not.

From the examination of the subject we have made to-night it will readily be seen what qualities a bur should possess, in order to commend itself to our favor and minister to the patient's comfort. In the first place, it should be made of the best steel, and so treated as to give it the best qualities possible. Next, it should be most carefully made, with keen, even, and regular cutting-edges, and perfectly smooth furrows. It should be well tempered and be perfectly true. The tool-holder or hand-piece in which it is carried must also necessarily run perfectly true.

In selecting our burs we should use a magnifying glass, in order the better to examine their various points. Having succeeded in getting the proper quality and kind of burs, we should be careful to employ them properly. For the excavating of living dentine, we should always use a new and sharp bur, lifting it frequently from the surface operated upon to prevent heating. The best results are generally obtained by running the bur rapidly. We should watch and see that the tool does not become clogged. This is less liable to occur in a dry cavity than in a wet one. We should frequently examine our stock of burs with a magnifier, and lay aside to be re-cut all those that show considerable signs of wearing.

Lastly, we should be liberal, almost prodigal, in the frequent purchase of the best burs. In this way we not only effect a valuable saving in our own and the patient's time, but add immensely to their comfort and our own reputation.

Discussion.

Dr. Leech.—I do not agree with Dr. Guilford in all he says in his paper. In regard to the difference in height of the cutting blades of a bur, the higher blades will cut out the pieces of dentine the same, if sharp, as the knives in a planing machine, and with as little pain as if they were all of the same height. The progress of course is not so rapid. Lately in excavating large cavities I have been using small corundum wheels, dipping them in water. I can grind almost to the pulp without giving pain. I think the pain inflicted by the use of the steel bur is caused more by the heat from friction than by the irregular height of the blades; a dull bur requires more pressure, which produces more friction, consequently more heat, and thus more pain.

Dr. Guilford.—I am undecided whether the same kind of burs will give the same amount of pain if run fast as they would if run slowly.

Dr. Bonwill.—If run with great velocity they will produce less pain, than when run slowly.

Dr. Guilford (to Dr. Bonwill).—What difference is there in the amount of pain produced by sharply-cut burs and dull ones?

Dr. Bonwill.—Sharply-cut burs produce less pain than dull ones, running at the same velocity.

Dr. Perry of New York.—For sharpening burs, I use a disk of photographers' tintype mounted upon a mandrel, using with it diamond powder and oil. With care the blades can be ground to a knife-edge.

The regular meeting was held at the office of Dr E. T. Darby, 1513 Walnut St., Saturday evening, October 17th, President Essig in the chair. The following paper was read:

ATMOSPHERIC PRESSURE IN ITS RELATION TO ARTIFICIAL DENTURES.

BY AMBLER TEES, D. D. S.

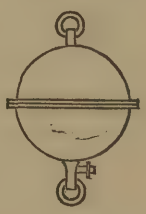
About thirty years ago, when it was customary to exhibit artificial dentures at the various fairs in competition for awards of merit, it was suggested by at least one of the dental journals that it was not the proper way to judge of the ability of a dentist, nor of the value of a set of teeth; that the award was just as apt to be given to a student or to a laboratory journeyman, who knew nothing whatever of preparing the mouth, adapting the plate or articulating the teeth; qualifications which distinguish the dental surgeon from the mechanical workman. Such exhibitions were therefore discouraged, and have gadually fallen into disrepute, but few, at the present day, resorting to that method of advertising their skill. The exhibition of the higher styles of dentures has been taken charge of by tooth manufacturers and dealers in dentist's supplies.

In the restoration of mastication, speech and facial expression it should be our aim to have the substitutes that we give our patients for the lost natural organs, excellent in every particular; to see that the plate fits well and gives no uneasiness nor pain, and to exhibit artistic taste in the selection of the color and size of the teeth and in their natural arrangement. It has been said that the tacit assumption that work itself is unpleasant, that difficulty is always disagreeable, that exertion is generally painful, and that we labor merely for pay, is the cause of so much inferior work. Let us combat this impression, and labor not only for the reward, for that is sweet to the most of us, but also for excellence, endeavoring to do better day by day.

I wish to direct your thoughts for a while this evening to a highly

important agent in securing comfortable adaptation of artificial dentures to the mucous membrane of the mouth, an agent which has almost wholly enabled us to dispense with spiral springs; I refer to atmospheric pressure.

Probably the most simple appliance for proving atmospheric pressure is the boy's toy, the sucker, at one time no doubt familiar to all of us. Otto Guericke was born in 1602 at Madgeburg, Germany. He invented the air-pump in 1650. He was burgomaster of the town for 35 years, and wrote works on physic. He also invented the Magdeburg hemispheres, which illustrate this principle fully. They consist of a pair of brass hemispheres with handles, fitting together without leakage, so as to form a sphere. From a stop-cock in one of them the air is exhausted by means of an air-pump, when it will be found almost impossible to pull them apart; when the air is again admitted they will separate. The cupping instruments used by surgeons act upon this principle, the vacuum being obtained by rarefying the air by means of heat or by steam generated by a spirit lamp.



The pressure of the air depends upon the fact that it is a heavy body. This is shown by exhausting the air from a glass flask and weighing it, when it will be found to weigh less than when filled with air.

Blaise Pascal was born in 1623 in Auvergne, South France. He was a genius possessed of wonderful talent for mathermatics, geometry and physics, having written a treatise on *conic sections* at the early age of fifteen, and later two dissertations on the *equilibrium of fluids* and on the *weight of the atmosphere*. In 1647, at the age of twenty-four years, he demonstrated that the atmosphere has weight by the following experiment: He procured a glass tube forty feet long closed at one end and filled it with water in a deep river. He then raised it vertically with the open end downwards, and found that the water ceased to fall in the tube when about thirty-three feet above the level of the water. He thus proved that a column of about thirty-three cubic feet of water was equal in weight to a column of atmospheric air of the same area and say fifty miles in height.

Evangelista Torricelli, inventor of the barometer, professor of mathematics and physics at the Academy in Florence, the successor to Galileo, was born in Faenza, Italy, in 1608. Plumbers were making a pump for the Duke of Florence, and found it impossible to make one that would raise water more than about thirty feet. Torricilli being apprised of this, and suspecting that the water rose in pumps through atmospheric pressure and not because nature abhorred a

vacuum, made a small pump of a glass tube, using mercury instead of water, and found that atmospheric pressure did the work.

If a tube thirty-four inches in length and one inch in area be filled with mercury and then inverted in a basin of mercury, the fact is made still plainer; the mercury in the tube will fall to about thirty inches. Now since mercury is thirteen and one-half times heavier than water, if we multiply thirty inches by thirteen and one-half the result will be a little more than thirty-three feet, the same as arrived at by Pascal in his water experiment. We therefore find that the atmosphere, say fifty miles high, exerts the same pressure upon the surface of the earth as would be exerted by a sea of water thirty-three feet in height and by a sea of mercury thirty inches in height.

Robert Boyle, an experimental philosopher, was born at Lismore in Ireland, in 1626. He improved the air-pump and made important disoveries in pneumatics. *Boyle's Law* is a statement of the fact that "the volume of a gas is inversely as to the pressure," that is, if the pressure upon a gas is doubled its volume is reduced one-half; if the pressue is tripled its volume is reduced to one-third. This is also called Mariotte's Law. (Mariotte was a French physicist, born in 1684.) They both enunciated the formula independently. Mr. Boyle discovered that the pressure of the air is not always the same, but undergoes many variations, the mercurial column sometimes falling to twenty-seven inches or rising to thirty-one. These changes are due to meteorological phenomena, the mercury falling at the approach of a storm.

The average height of the mercurial column therefore, being thirty inches, and as every thirty cubic inches of mercury weighs fifteen pounds, there is an average pressure of the atmosphere upon every square inch of the surface of the earth at the level of the sea of fifteen pounds. A man of average size at this level sustains on the surface of his body a pressure of thirty thousand pounds, but the pressure being exerted upwards, downwards and laterally he does not feel it. As we ascend the mountains or go up in a balloon, the volume of air decreasing, the pressure also will decrease, and by means of tables prepared for the purpose and the barometer, we can ascertain the height at any point.

The contact by atmospheric pressure of an upper artificial denture with the mucous membrane may be likened to the Magdeburg hemispheres. The denture representing one hemisphere and the superior maxillary bones and the cranium the other, the air within the mouth, within the nares and against the cranium causing the pressure. This contact is sometimes spoken of as adhesion. Adhesion is the union of the particles of one or more hard substances of the same or of different natures by means of a third of a softer nature, which may

harden or not afterwards, or the union of a hard and soft substance. Two boards pressed together by the hands do not adhere, for if the pressure be removed they will fall apart.

Confounding this pressure with adhesion it has been argued that a very heavy set of teeth endangers the mucous tissues, that such a set will in course of time tear away these tissues from their bony attachments. No fear, however, need be entertained from this source, for the gums are rather compressed than otherwise, and are in the same relative position between the bone and the plate as a piece of wax between the thumb and finger. The only part of the tissues which could possibly be stripped off lies within the chamber. This is, however, subject only to a morbid growth which is seldom accompanied by inflammation; and this, in the majority of instances, only taking place when the vegetable bases or Cleveland chambers are used. A denture weighing sixty pounds, with a surface of at least four square inches, the pressure being perfect, could be sustained without affecting the mucous membrane more injuriously than a set weighing one half ounce, because the lighter the set the harder the pressure against the gums, and by pressure alone can they be injured.

What is called *vacuum by contact* is when no chamber is used. The first plate was made in this way by Dr. James Gardette, of Philadelphia. About the year 1845 chambers were first introduced, and there have been several claimants for the honor of the discovery. I have heard that Dr. Mallett, of New Haven, stumbled upon the plan by making a plate from an impression which was imperfect in the roof of the mouth. Many dentists object to the vacuum chamber, but after years of experience I do not recall any cases in which any objections could be urged against its use. To form it I use thin pieces of wax base-plate. I have swaged, in a few instances, two plates for the same mouth, one with a chamber and one without, and have found the pressure so much stronger in the former that in every case I have discarded the latter.

Although an accurate impression is a prerequisite in making a perfect-fitting plate with atmospheric pressure, yet there are many mouths which cannot be fitted from accurate impressions. This may seem paradoxical, but yet it is so; and the young practitioner who thinks that success is assured him because he has learned to take perfect plaster impressions, will become demoralized in this direction before many patients patronize him.

In many cases it is necessary to cut away the plaster casts in certain parts and manipulate a trial plate before a pressure can be established, so variable are the gums in thickness and density.

I have brought a few casts with me to show you in what kind of mouths this is necessary, and to explain to you the way in which an

experienced dentist can tell, when a patient comes to him for an upper artificial denture, by a slight examination of the mouth and condition of the gums, whether he will be likely to encounter any difficulties or not.

(*On the blackboard.*)

Success in obtaining a firm pressure depends a great deal upon the curve of the posterior part of the roof of the mouth, commonly called the palatine arch. If it is peaked or egg-shaped, as in Fig. 1, it will be necessary to manipulate the plate. It is better to use a trial plate made of pure silver, No. 28. Then cut away the plaster cast at the posterior edge of the chamber and in other places where the gum is soft, and burnish the silver to conform to it until the pressure is established. Pure silver being very soft will readily yield to the burnisher. Plaster is then run into this plate and used as the cast for further operations. I will pass around a cast of a mouth of this description, showing where the plaster has been cut away. The lady had been wearing a rubber plate for a number of years of a poor adaptation until I made her a continuous gum set and established a satisfactory pressure in this way.

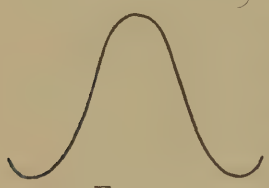


FIG. 1.

If the arch is semi-circular, as in Fig. 2, and the gums hard, the atmospheric pressure will be good; but not as perfect as in Fig. 3, which shape produces the very best results. If the gums are hard, and the shape is as in Fig. 4, we will get a better pressure than in one the shape of Fig. 2. But if they are soft and fissured, no more troublesome cases can be presented. The cast which Dr. Darby hands me conforms to Fig. 4, and if there are no fissures, and the chamber is placed in the posterior part, as in Fig. 5, it will not be a troublesome mouth to fit.

FIG. 2.

FIG. 3.

FIG. 4.

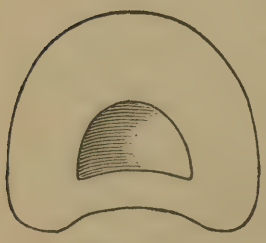


FIG. 5.

An old gentleman called upon me several years since, and wished me to make him a set of teeth. He said he had been all over the United States endeavoring to get a set with which he could masticate. The arch corresponded to that of Fig. 4, and was very spongy and fissured. After many experiments upon properly locating the chamber, I was successful in getting a firm pressure by carrying its margins within an eighth

of an inch of the centre of the alveolar ridge, and posterior to all the fissures, as in Fig. 6. (The dotted lines represent the centre of the ridge.) The cavity plate was made of very thin wax.

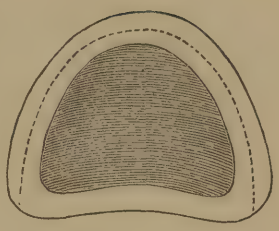


Fig. 6.

Many plates ride forward after the air is exhausted, making a space, very often, an eighth of an inch between the anterior portion of the alveolar ridge and the plate. (The dotted lines in Fig. 7 represent the plate.) I correct this by swaging a pure silver plate, No. 28, and extending it only to the centre of the alveolar ridge. This is placed in the mouth, the air exhausted, and an impression taken. A plaster cast is taken from this, with the silver plate remaining in it, and used to finish the set with.

Fig. 7.

In upper and lower dentures, the lower should be finished first, so that if any change has taken place in the position of the teeth, the upper ones can be changed to antagonize properly. Much care in articulating should be observed, since tilting of the plate and admission of air into the chamber is caused by carelessness in this respect. The upper bicuspids and molars should be so articulated that their cusps are directly under the alveolar ridge; and when the pressure is weak, the natural articulation of the lower ones should be reversed.

Much trouble and disappointment is occasioned, both to the patient and dentist, by inserting upper sets without supplying lost lower bicuspids and molars. These should be inserted and worn, at least a week or two, before the upper ones are made, and for the sake of his reputation, and the avoidance of much annoyance, the dentist should insist upon this being done.

The slight shrinkage of zinc at the alveolar ridge makes it preferable for the male die in metal work. When the air is exhausted, it causes a pressure upon the alveolar ridge, and thus prevents the plate rocking. For the same reason a shallow zinc die is better than tin in rubber and celluloid sets. Babbitt metal, perhaps, would be better for a finishing die when the arch conforms to that of Fig. 1, since the pressure in such cases should be upon the palatine arch.

Discussion.

Dr. Buckingham.—We all have to manipulate many plates in various ways, and there is great utility in scraping the plaster casts in certain parts. Many patients do not know how to exhaust the air. For artificial dentures, continuous gum-work is the best, and celluloid the next. If the latter is pressed upon a metallic cast, sufficient heat

applied to soften it properly, and plain teeth used, it will make an excellent denture, which will not warp.

Dr. Lukens Long.—To conceal the disagreeable taste of the plaster, in taking impressions, I mix it with oil of wintergreen.

Dr. Darby.—I have a contempt for men who ignore mechanical dentistry, and am glad Dr. Tees has presented a paper on the subject. Did I wish to make a competent dentist of my son, I think I should have him spend three years in a laboratory, under the best instructor I could find. There is no department of our specialty that requires more skill than the mechanical or prosthetic, and there is no part which receives so little attention in our dental societies. The day will never come, at least it will not come for many generations, when people will not require artificial teeth, and why should the great majority of the so-called best men in the profession ignore a branch which requires so much skill and good judgment for its accomplishment? I shall be glad when the proceedings of this meeting are published, that the profession at large may see that this society has spent an evening discussing artificial dentistry.

The regular meeting was held Saturday evening, November 4th, 1882, at the office of Dr. T. L. Buckingham, Arch Street, President Essig in the chair. The following essay was read:

INGRAFTING OF ARTIFICIAL CROWNS.

BY H. K. LEECH, D. D. S.

The subject of my essay this evening is a new method of ingrafting artificial crowns on natural roots. That there is a number of good methods we will not question; and it is with the hope that this new way of attaching them will prove another good one, and as such will fill its niche, that I take pleasure in presenting it for your inspection. That to securely fix artificial crowns to natural roots is desirable is unquestionable; but with all of the methods that we have heretofore had, there have been difficulties at times which have seemed insurmountable, and failure has followed when we most desired success.

In reviewing some of our methods, take, for instance, the gold peg crown, which, I think, has been one of our best—a plain plate tooth, with gold backing, and gold pin or pivot to be inserted into the root. If the root is very much decayed when one of these is used, and where a large amount of gutta percha or cement has to be depended upon to hold it in place, it is almost always sure to become loosened

after a short time. The method of grooving the crown and building it to the root by foil, as suggested and performed by Dr. Webb, is in a good measure impracticable, from the fact that none but the most skilful operators can perform it. Then the manner of securing them by a screw and nut. How soon the latter becomes loose must be clear to every operator. Taking one of our latest methods into consideration (I refer to Dr. Bonwill's method of setting crowns), with this, even when we make a good attachment, there is generally the objectionable feature of the black line at the margin of the gums from the amalgam; also the frailty, and the often-required renewal of the crowns from the fact that they must necessarily be weakened by being hollowed out, thus leaving the walls thin, in order to hold sufficient amalgam to make the band between the crown and root strong. Then we have the objection that unless great care is used by the patient, the whole thing is loosened before the amalgam has time to set.

Now while I raise objections to the above-mentioned ways of setting or ingrafting crowns, it is not for the sake of condemnation, for in many cases they do all that is required of them; but it is to show by their defects that we have not yet arrived at perfection in this so frequently called for operation, so that any hint I may give, or any new idea present that has any worth, will at least be one step in a progressive direction toward the end.

The manner of attaching crowns which I am about to present to you, I think will overcome a great many of the objections which I have alluded to above, and has the following qualities to recommend it:—

1st. You can make an unobjectionable and tight joint with the root.

2d. You can make firm attachment.

3d. It is easily and accurately applied.

4th. Roots that are sufficiently strong to be filled are applicable.

5th. It will compare favorably with the strongest manner of setting crowns.

6th. It can be done at one sitting, and does not require more than ordinary skill to adjust them.

An explanation of these diagrams will assist in defining the operation. *Fig. 1* is the root, and is prepared by grinding off to a little below the margin of the gum, giving it a concave shape from before, backwards, the lateral margin being the highest; then drilling or cleaning it out for the reception of the attachment, which should go in loosely, leaving or making a small undercut as illustrated at *a;* the apex of the root should then be permanently filled.

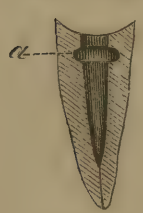


FIG. 1.

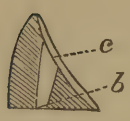


FIG. 2.

Fig. 2. is a sectional view of the crown, and is similar to the wooden peg pivot-tooth, excepting that the hole *b* runs all the way through the crown, and is made tapering, the largest part of the taper being at *c*.

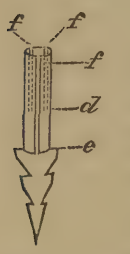


FIG. 3.

Fig. 3 is the attachment, and is a cylinder of gold (*d*) soldered to a flattened gold wire (*e*). This is made by taking a piece of 18-karat gold plate of about No. 29 or 30 gauge thickness, of the desired length, etc., and bending it around a small piece of wire or a broach, making it of the same diameter as the hole in the crown at *b*, *Fig. 2*, which should be a little more than one-sixteenth of an inch; this is then soldered to the gold wire *e*, which is made tapering and roughened, and should be larger than the cylinder at the point where it joins, for reasons which will be explained further on. The cylinder should then be split with a small separating file or saw, as at *fff*.

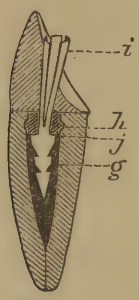


FIG. 4.

Fig. 4 illustrates the manner of making the attachment. After grinding the crown to fit the root, prepared as before stated, a little oxyphosphate, gutta percha (*g*) or some quick-setting cement is used to hold the attachment in place, the crown being temporarily slipped on, so that the adjustment will be correct, until the cement, etc., become firm; then take off the crown and pack the root around the wire and cylinder at *h*, as in *Fig. 4*, with either gold foil or amalgam, the gold being preferable; this will then secure the attachment; now warm a little gutta percha, just enough to make a joint between the crown and root, and slip the crown on the cylinder, pressing it tightly against the root so as to squeeze out any excess of the gutta percha; then take a taper instrument and run it in the cylinder, spreading it out to conform to the taper in the crown, as at *i*, filling and packing it tightly with gold foil. It will be seen by reference to *Fig. 4*, that the gold foil or amalgam packed against shoulder *j* of the cylinder, and into the undercut *h*, will so secure the attachment that it cannot be easily loosened, and the wedging of the cylinder, open at *i*, and filling it carefully with gold foil, will make it as strong as a solid wire of gold, at the same time so shaping the cylinder that it makes it almost impossible for the crown to come off or become loose.

In conclusion, I claim for this method the most accurate, strong and easy way of ingrafting crowns that we have heretofore possessed. I do not claim for it perfection, but a step forward in the right direction.

Discussion.

Dr. Darby.—I think these crowns would be stronger if a platina tube was baked in them, the same as in Ash's teeth.

Dr. Bonwill.—The tooth crown, as shown by Dr. Leech, is of very old construction. The split cylinder is a slight change from a split pin, which has been used. The burnishing or riveting the end of the cylinder to the crown is about one of the weakest plans to be called an improvement over mine that has been put forth. To contrast such with the all-porcelain crown shows clearly that the latter plan is not understood by the gentleman. Dr. Leech speaks of it as a failure in his hands. I would like to know from him in what particular. The best endorsement my crowns can have has been the sale of fifty thousand in eighteen months. At the January meeting I will read a paper setting forth, by models, etc., all improvements to this date, and contrast the few plans adopted, and show the weak and strong points. A matter of such importance cannot come in as a sequel to this evening's proceedings. It would be well when criticisms are made upon the productions of others, that specific details be given, and reasons therefor be sustained. Mere assertions of an individual have no weight. One-third of my crowns put upon the market were not correctly made, and should not have been sold. There is no excuse, however, for any one who read my article in the June number, 1882, of the *Dental Cosmos*. I called attention to the defects, and have many times asked the manufacturers to throw out all defective crowns. If he had carried out my plan in every particular, Dr. Leech could not come here and pronounce it a failure, and call for a greater improvement. Certain mechanical and philosophical principles underlie all our operations, and no fancy idea otherwise can be of any value.

Dr. Register.—I have used amalgam for setting crowns since 1870 or '71. At that time I did not know of its use by any other person, and did not think very much of it myself. My method then was to convert a plain vulcanite tooth into a graft crown, by vulcanizing a rubber backing of the desired shape to it, and cutting a hole through it between the pins, and dovetailing the grinding surface so that the screw would bear on them. The root was prepared, and a wooden peg fitted into the upper half of the canal, and driven home dry; the alloy was then filled into the lower part, and a gold screw, passing through the crown and the alloy into the wood, brought the root and crown nicely together. These crowns have done good service, when the pin did not become mercurialized. My present method is to retain the shape of the natural crown, and prepare the

anterior and posterior faces of the root to conform to it, often making the joint one-quarter to three-eighths of an inch above the gum line. I endeavor to reach the peridental membrane, and always to carry the bevel of the neck well up under the gum. To prepare the root, the gum can be locally anæsthetized with rhigolene or ether, sprayed upon it; or you can cut directly through the gum, making a lacerated wound, which does not bleed much. After an adaptation is partially made, a button of phosphate or oxide of zinc should be forced into the canal, and over the entire face of the root, and the gum pushed back as much as possible; this should be allowed to harden, and remain in a few days. The membrane heals nicely around the root, and its face is nicely exposed. The artificial crown is made much stronger by having a platina matrix burned in it. This will take away nearly all the strain the operator or patient may put upon the tooth. In adapting the post, it is commendable to fill the upper portion of the canal with phosphate of zinc, and to push the post into it, then placing the tooth in position, and allowing the filling to set. This saves after-trouble, as the post is thus directed correctly, and the alloy or gold can be neatly packed afterwards. The teeth are the same moulds as I use for grafting, in lieu of plates. When a gutta percha or phosphate of zinc attachment is desirable, it is only necessary to adapt the post temporarily in position, and make a facing of light platina over the root, which is easily done by allowing the metal post to pass through it and gently mallet it to place. To this grind the tooth to fit as nicely as possible, making the proper articulation. Afterwards the post can be loosened, the three parts waxed in proper position, removed together, and soldered with gold. The after-adaptation is beautiful, and the whole preparation quickly done.

Dr. J. A. Woodward.—The following case recently came under my observation: A lady patient, in one of the Western cities, had a Richmond crown placed upon a superior second bicuspid root. Within a month the crown and root were taken from the mouth with the fingers, and were followed later by considerable loss of the alveolar process, partially baring the roots of the first bicuspid and first molar teeth. The root was about half its original length, was bifurcated and tapered rapidly towards the apex. The band of the gold crown extended nearly to the bifurcation, and stood off the root all around about one thirty-second of an inch. The crown was beautifully made, and had it been mounted upon a better root would have done excellent service. It is a demonstration of the risk taken when these crowns are placed upon all the roots to which it is possible to attach them.

Dr. Tees.—I use lateral pivot-teeth for restoring the buccal por-

tions of bicuspids, so frequently broken away when these teeth are devitalized. By shaping properly the cutting edges, they resemble the bicuspids closer than the canine pivot teeth do. The hole is drilled entirely through, by means of corundum wheels and points. A platina pin, the diameter of this hole, is anchored in the root canal, and amalgam packed around it. The pivot-tooth and the palatine portion of the bicuspid are trimmed so that the former can easily be slipped upon the projecting part of the pin. Amalgam is then packed between them, and polished at a subsequent sitting.

Dr. Chupein presented specimens of cups for taking plaster impressions, made of thick, perforated tin-foil.

The regular meeting was held at the residence of Dr. Daniel Neall, 1627 Summer Street, December 2, 1882, the president in the chair.

Dr. F. M. Dixon read a paper on

THE PROPHYLACTIC PROPERTIES OF TIN.

Discussion.

Dr. James Truman.—I indorse most fully all that Dr. Dixon has said in regard to tin, having regarded it throughout my professional life as one of the most valuable filling-materials we have, when used under certain conditions. Increased experience simply confirms the conclusions of the past, and to me it is surprising that so few realize that this metal, properly prepared, possessess advantages, in a certain class of cases, not found in any other material. If properly manipulated it can be made of a density sufficient to resist all ordinary wear from attrition, and in its power of resisting caries it has few equals and no superiors. Inquiring at the dental depots I find the demand very limited. This is probably due to the fact that its use requires the same skill and time in packing as cohesive gold, as it must be manipulated in the same way as the latter to produce the best results. Amalgam has, therefore, taken its place in the practice of the majority, and the mode of manipulation of tin promises to become a lost art. That this is a serious mistake is very clear to those who have made the most use of this metal. The idea that it will not answer for masticating surfaces is a very erroneous one, as I have seen it in numerous mouths in constant wear for many years without appreciable loss. As a base for gold, a sheet of tin and one of gold is regarded by some of the European dentists as having a greater power of resistance to

decay than when gold is used alone. Whether this is true or not, the great value of this combination of tin and gold cannot be a successfully disputed. It has also a valuable place as a lining for sensitive cavities, and if properly manipulated around the walls will very effectually guard the irritated tissues from thermal action, a most important matter, especially in young teeth. The facility with which this metal can be condensed on the cohesive principle in presence of moisture renders it of service in those cases where moisture cannot be wholly excluded. Fillings inserted damp seem to result very satisfactorily.

Dr. Buckingham.—Gold fillings fail on account of defective manipulation, because the gold is not well adapted to the surface of the cavity. The preservative properties of tin depend upon the lead in it. If it was pure it would not turn black, the oxide of tin being white. Tin foil often becomes oxidized in the books before it is used. Children's temporary teeth should be filled with tin; it is better than amalgam and as good as gold. Electricity as a current has nothing to do with decay under a filling. When a filling in a tooth sets up electrical action it is only local.

Dr. Register.—The fundamental principles underlying the treatment of diseased teeth are not, as a rule, appreciated. Fully fifty per cent. of the fillings inserted are utter failures; twenty-five per cent. more do but temporarily check decay. I believe that not more than one-quarter of all the fillings inserted act as curative agents —not more than that proportion which do not require refilling inside of from ten to twenty years. Dental caries is no chance condition, nor is it, as a rule, to be checked by chance, although this does happen occasionally. If our aim is to be useful in restoring lost parts, the filling-material must be compatible with the individual tooth tissue, in order to be tolerated, and the adaptation must be perfect. Vital dentine has the power of recuperation, and when properly protected the tooth is again as strictly normal as any tissue which bears the marks of a cicatrice. Tin is a good therapeutic and prophylactic agent, for the simple reason that it is capable of easy and perfect adaptability without injuring the tooth-structure. The most perfect cohesive gold fillings return to their maximum hardness, the artificial physical condition of the gold not being permanent. In six months a filling of this kind will be no harder than if made of soft foil in a perfect manner, and as a rule it is not so perfectly adapted. The weld should be confined to the enamel walls only. With soft gold foil worked with proper instruments we get the same condition as with tin, with a more pleasing appearance. I use them both in the shape of cylinders and tape; but there are conditions of tooth-struc-

ture and also difficult positions, where neither the mallet nor hand-force is desirable upon an unyielding material. In such cases I have had the most satisfactory results with the combination of gold and alloy. A perfect filling can be thus made and contoured in the most difficult place, and the organ restored to its normal condition.

Dr. Guilford.—I have been entertained and instructed by Dr. Dixon's paper. The value that he places upon tin as a filling-material, both in its mechanical and therapeutical aspects I consider none too high. He has found it so in his practice and I have in mine. I think we have all been more or less demoralized by amalgam through the prominence that has been given to it in the past ten years. Amalgam excels tin in one quality only, that of hardness or resistance to force in attrition. In all other qualities tin is the peer of amalgam, and yet how seldem do we hear it spoken of and still more seldom do we see it used. More than this, tin has never had justice done it in regard to hardness. It wears longer than we generally give it credit for. In the earlier years of my practice I used tin a great deal and was always pleased with the results. I have used it less in later years, only because I could manipulate amalgam more quickly. Of course, on large masticating surfaces or for building up, amalgam should be preferred to tin; but in small crown cavities where we do not want to use gold, on buccal surfaces and in cavities difficult of access, and on approximal surfaces, tin is often superior to all other metallic fillings. Its extreme softness, ease of manipulation, adaptability to walls, ductility under the burnisher, low conductivity, and therapeusis by oxidation make it an excellent material for the filling of teeth. For the repair of any metallic fillings in out-of-the-way places it is by far the best material we have. I am glad the essayist has brought the subject to our notice again, and I feel convinced that if we were all to use this material more than we do, we would further the best interests of our patients and ourselves.

Dr. Darby.—For many months past I have been in the habit of using gold and tin in combination in the same tooth. My method of using it is to take a leaf of gold and place upon it a leaf of tin foil; the two are then folded twice and cut into strips. The tin is hidden from view but comes to the surface as the two are consolidated. In my clinic this afternoon at the University I selected a very large cavity situated on the masticating surface of an inferior molar. Into this cavity was packed about two leaves of gold and two of tin. When the surface was approached I used gold alone that the appearance of the tin should be prevented. The operation required much less time than would have been necessary to make the filling entirely of gold, and in my opinion is just as good, if not better. The com-

bination was not made with the hope of obtaining any beneficial result from the tin, but simply to demonstrate to the class the method of using the metals in combination. I do believe, however, that had the cavity been on the approximal surface of the tooth, and the tin and gold, used at the cervical border of the cavity it would have been productive of good results in consequence of the chemical change which takes place when two dissimilar metals are used in combination.

Dr. Daniel Neall.—I never expect to go back to tin. I jumped from gold to amalgam long ago. Give me the gold we had from 1848 to 1862 and I can put it anywhere that you can put tin; such gold was "as soft as butter and as tough as hemp," to quote an old dentist. You cannot pack gold nor tin into obscure cervical cavities as you can amalgam, and as regards union, or assimilation, or therapeutical effect, I should as soon trust it as tin.

Dr. Bonwill.—There is not a dentist of any character who did not in his early practice resort to tin when for various reasons gold could not be used, and who did not refuse to use amalgam when anything else could be made available. No one ever doubted for an instant the value of tin as a preventive of caries, nor its influence upon the peripheral borders of the cavity. Men have time and again exhausted their patience and energies in the use of tin and gold rather than use amalgam, from the fear of the public or from prejudice. I attribute the true preservative qualities of tin to its easy adaptability to the walls of the cavity and its low conductivity, rather than to any compatibility with dentine. During the first eight years of my practice I did not use an amalgam filling. I took the same trouble to pack tin as I did gold, and with happy influence upon the tooth so far as caries was concerned, but it did not last; its contour would change. Tin can be packed with sharp-pointed instruments and be made to weld apparently as solid as gold foil; even wet tin fillings in grinding surfaces allow of no further decay. Its soft nature admits of absolute contact with the walls, and when this is secured, I do not care whether it be gold, tin, or amalgam that is used, a filling will be successful. When there is no capillary tube between dentine and filling, caries will not again commence at that point unless decay has not been removed or the margins have not been carried over far out of the way, where decomposing substances cannot remain at the margin of the filling and dentine. It is the observance of mechanical details, from the preparation of the cavity to the proper shaping of its peripheries, the outline of the filling, and the relation it bears to surrounding tooth-structure, rather than the material which is used, that makes one filling more than another a better prophylactic against

caries. If we could control our patients and keep all cavities within a certain radius, observing decay before it has so far progressed as to involve too much structure, we could often use tin ; but why not use gold? In such cavities it requires no more labor nor is it more difficult to place soft gold foil. I cannot understand how any one who has approximo-grinding surface fillings to insert, needing all the support he can possibly give them, can afford to forsake gold for tin. In such cases we can do greater justice to our patients and to ourselves by the use of amalgam.

1883.

The regular meeting was held Saturday evening, April 7, 1883, at the office of Dr. Essig. President Essig in the chair. A paper was read on

PLASTER IMPRESSIONS.

BY S. E. GILBERT, D. D. S.

I regret that so many of the profession have discarded plaster in part, if not wholly, for taking impressions. This is the only material that will afford a perfect impression in difficult cases, with all the others an after-carving being necessary. The excuse given for not employing it is that plaster is very objectionable to patients. I find that by manipulating plaster with care and neatness few object to its use, particularly if patients are made to understand that a correct impression is required and that the result is best obtained by using it. They are pleased to know that plaster can be used but once, and that, therefore, it is clean. With wax or with modelling composition they are not so sure of this cleanliness, and often look upon such materials with distrust. The reason that patients object to the use of plaster is more often the fault of the operator than of the material. Of course, objections will be made if the pasty mass is allowed to run back into the throat, or when the patient's face, hair, or clothes are smeared, but these mishaps are not necessities for the taking of either partial or full impressions. More skill is required in using plaster than in the employment of wax or modelling composition, but when an impression is obtained with the former the operator is repaid in having one which he knows to be perfect.

In taking an impression, first examine the mouth with a view to the selection of a cup adapted to the case. If it is a full upper with a shallow arch, the cup is to be flat. If the muscles extend far down

upon the alveolar ridge, the sides of the cup are to be correspondingly low; or if the arch is high and the ridge prominent, the cup is to be elevated in the center and around the edges. To prevent the plaster extending too far back, build a rim of wax across the heel of the cup; place this in the mouth, allowing the wax to rest gently upon the posterior edge of the hard palate. Mix the plaster free from air-blubbles, and place a sufficient quantity in the impression-cup, being careful not to overload it. Dry the palatine portion of the mouth with a napkin, and place a little plaster in the high part of the arch, working it into position, and taking care to exclude all air-bubbles. The cup and plaster are now gently forced into place, allowing the posterior portion to be pressed up slightly in advance of the anterior part. This forces the plaster where it is needed, namely, at the sides and in front. The cheeks and lips are pressed against the material, which, after setting, is removed and the cast run.

In partial cases it is more difficult to obtain a good impression, many making it more so by reason of removing the plaster before it has set, their desire being to obtain an impression without fracture. This may be done, where there are no undercuts nor dovetails by allowing the plaster to set so that it will fracture without crushing; but if there are any undercuts it is altogether wrong, as there are comparatively few partial impressions that can be removed whole and be at the same time correct. The plaster should be hard before any attempt is made at its removal. Take, for instance, a lower case where there is partial anchylosis of the articulation, the teeth standing in different directions, forming dovetails and undercuts. Select a suitable cup and fill with a sufficiency of plaster. Insert this into the mouth. Force the cheeks and muscles out with the fingers, gently working the cup into place. When this is done and while the plaster remains soft, press the cheeks and lips against the paste, allowing time for hardening; carefully remove the cup, leaving the plaster in the mouth. With a thin-bladed knife cut a line through the plaster down to the masticating surfaces of the teeth, and where these are absent cut a little deeper. Insert the knife-blade in this line on one side and carefully twist it. This breaks the plaster away from the outside of the arch. Repeat the same on the opposite side, and, following this in front, that remaining on the inside of the teeth is pressed inward with the finger, when it will fracture and is easily removed. Perhaps, however, some of the plaster will cling closely between the teeth that form the dovetails. This is to be fractured with a knife, and removed before the attempt is made to separate that upon the inside of the teeth. After removing the impression, the pieces are to

be replaced in the cup according to their original position, care being taken that no particles of plaster are in the way to prevent absolute apposition. When all are in place and the cast run, we feel certain that we have an impression that is in every way all that is to be desired. For partial cases, the teeth being loose, an impression may be taken as follows: first, obtain an impression in wax; run a cast in this and fit a wax cap over the teeth, so trimming that the necks of the teeth and gums are exposed. Place this in the mouth and take an impression in plaster after the usual manner. Remove when hard, and a perfect impression of the soft parts and necks of the teeth will be found to have been secured, and with little or no inconvenience to the patient.

In partial uppers where there are enough teeth remaining to retain the plaster, place the paste in the mouth, filling it even with the masticating surfaces of the teeth. This leaves the cup free; but in some cases, especially when the teeth are absent, it is necessary to place a little plaster around the edges of the cup. Build a thin rim of wax at the heel of the cup—which is passed into the mouth beyond the plaster—then draw forward and gently press into place, thus causing the heel to go up first, and forcing the plaster out where it is needed, and not into the throat. A case in practice was as follows: The central incisors and molars leaned inward; the molars upon one side tipped forward and upon the opposite side they leaned backward. The plaster and cup were inserted as described above. After the impression had set hard, the cup was removed, leaving the plaster (and wax that had been placed across the cup) in the mouth. With a pair of foil-pliers the wax was removed, as also what plaster had been forced over it. This left the posterior portion of the mouth free. The line was now cut over the teeth after the manner described in the lower case. The knife-blade was next inserted in the line cut over the masticating surfaces of the teeth upon one side, and by twisting it the plaster was fractured to the line opposite the cuspid. The piece thus secured was removed; then the opposite side and front were treated in the same manner. The palatal portion still remained fastened with a strong dovetail. With the knife a line was cut about a quarter of an inch from the molars and nearly through to the hard palate, beginning back and coming forward to the cuspid; the knife-blade was then placed in the crevice and twisted enough to fracture the plaster. This piece was taken out, and the remainder removed by inserting an instrument (bent at an acute angle, and flattened) between the plaster and palate, drawing it down gently.

Familiarity with plaster as an impression-material cannot fail to recommend it as an agent well adapted to the ends desired. That it

requires a varied experience is clear enough to all attempting its manipulation. It will, however, repay many times the cost and labor of overcoming the difficulties associated with its use.

Discussion.

Dr. Bonsall.—I do not believe in capping molars with wax previous to taking a plaster impression, as suggested by Dr. Gilbert. I have taken them in this way but the practice is wrong; it is impossible to get a perfect impression, as the wax will drag around the teeth in removing it. To make a perfect denture we must have an accurate impression of the necks of the teeth. Some patients have very sensitive mouths—so much so, that it is impossible to use a napkin in filling a tooth. May I ask Dr. Gilbert how he would manage in such a mouth to take a plaster impression?

Dr. Gilbert.—I would build a thin rim of wax across the heel of the cup, and by carrying this up in advance of the anterior portion the plaster is forced to the front and sides.

Dr. Register.—When an atmospheric plate is required, I do not think plaster gives us the best results, it merely taking an impression of the hard and soft tissues as naturally found. Thus, if the membrane is universally hard, or soft only in small, isolated spots, all will be satisfactory; but in the majority of cases the tissues are firm in one part of the ridge or palate, and soft and yielding in another part. In such cases pressure is resisted by the former, and the soft membrane is compressed as the air is exhausted, causing an unsatisfactory impression. In these cases we want something which will harmonize the whole surface, so that when the air is exhausted the plate will press equally upon the hard and soft tissues, thus preventing the possibility of tilting. For this reason, an exact negative of the mouth is not always to be devoutly wished for. This has been demonstrated in the successful use of mineral plates that have been adapted by the disk to approximate a perfect atmospheric denture. When clasps are to be used I do not think a discrimination necessary, other than to use that which is easiest and most comfortable to your patient, as good results for these cases can be gotten from any carefully prepared material. In my own practice I have used exclusively for several years the modelling compound, with universally good results, preferring the medium and hard, and using the former on hard palates and the latter on soft ones.

Dr. Wood.—In cases of very sensitive mucous membrane, I prevent spasms of the stomach when taking impressions by placing the patient straight up in the chair or leaning forward, so that the saliva

will run out of the mouth. This relieves the patient of much anxiety, and frequently prevents retching. In taking impressions in plaster, the cup should first be placed against the anterior part of the mouth and gradually brought up to the posterior part, in order to expel the air and prevent bubbles. In the case mentioned by Dr. Gilbert, where the teeth had large crowns and small necks, to get a good impression I would first take a wax impression (having the wax well secured to the cup by melting the adjoining surface), then cut out the wax around the impression of each tooth, the cavities representing in shape inverted cones. Fill these cavities with plaster not too thick; place a thin coating over the balance of the impression and reinsert in the mouth, pressing quickly and thoroughly to place. When the impression is removed, the larger masses of plaster will remain about the teeth, but can readily be fractured and fitted into their proper places.

Dr. Gilbert.—In sensitive mouths it is sometimes necessary to give bromide of potassium half or three-quarters of an hour previous to taking the impression. This generally prevents retching.

Dr. Jas. Truman.—Impressions may be taken well with almost any of the materials employed for this purpose, provided care is used in the manipulation. Plaster, wax, modelling compound, and even gutta-percha are efficient under certain conditions; but judgment is required with any or all of them. A professional acquaintance used the latter almost exclusively and with remarkable success. I have made use of plaster for the past thirty years, and, as a rule, prefer it to other materials, especially in soft conditions of the mucous membrane. Plaster can be used so soft as not to materially disturb the normal position, while any of the others will press the parts out of place and act as a spring to force the plate down, rendering it very difficult to obtain permanent adhesion by atmospheric pressure. For the past few years I have almost abandoned plaster for lower impressions, as the modelling compound gives very satisfactory results, and without the annoyances consequent in the use of either plaster or wax; but it should be kept in the mouth until hard enough to be removed without danger of change in form.

Dr. Guilford.—I was much pleased with Dr. Gilbert's paper. It was clear, concise, and practical. The subject is the most important one in the whole range of prosthetic dentistry. The materials for and methods of taking impressions are many. Gutta-percha, so largely used and recommended by English dentists, has found but little favor here, and beeswax, once so generally used, is employed by comparatively few dentists to-day. The introduction of the modelling compound has almost marked a new era in the taking of impressions.

When the quality is good, and it is properly manipulated, and not taken from the mouth before it is entirely hard, the result is usually very satisfactory. It combines the plasticity of wax with the sharpness and hardness of plaster. For the taking of difficult partial impressions it is certainly very superior. Plaster, of course, takes the sharpest and most perfect impression, and wherever it can be used without too great discomfort to the patient or annoyance to the operator it should be employed. For one, I have never attained such proficiency in its use as to lead me to take all impressions with it, as some dentists do. In all normal and in most partial cases I use and prefer it, but in difficult partial cases I generally use the modelling compound. We can often use a combination of two materials, such as plaster and wax, with the happiest results. The well known method of taking an impression in wax, trimming a layer from its surface and scoring it, and then reintroducing it with soft plaster on its surface, is a most excellent one. We get a sharp plaster impression which is removed from the mouth without difficulty. Another good plan is to put pieces of wax on the cup at points corresponding to the natural teeth remaining in the mouth. Then, keeping the wax warm and plastic, we mix our plaster and fill the balance of the cup with it. The teeth enter the wax and the balance of the impression is taken in plaster. This has the advantage over the previous method of not allowing the plaster to get into the depressions made by the natural teeth in the wax. In cases, too, where the oral portion of the alveolar ridge has become soft and flabby from previous wearing of a partial plate, and the balance of the ridge remains normally hard, I combine the wax and plaster by first taking a wax impression and not trimming it any where the ridge is soft, but at all other portions, and retake in plaster. By this means the soft part is taken under pressure, with the balance in a state of repose. I feel that I thus get results that I could not get by the use of any one material alone. In my teaching I try to emphasize the point that in selecting the material for an impression we must use our judgment and be governed by the conditions of the case.

Dr. Maxfield.—I find, in making partial plates on casts made from plaster impressions, which have to be broken in order to remove them from the mouth, that I have to do considerable trimming to the plates to make them go into their places. I have been more successful in such cases with the modelling compound, as the amount it draws in removing from the mouth is an advantage, in that plates must be so made that patients shall have no trouble in removing them when they desire. For full sets I much prefer plaster, as with nothing else can I get such perfect fitting plates.

Dr. Buckingham.—It is difficult to adopt any certain rule for taking impressions. In the majority of cases plaster is the most certain; we can get the rugæ more perfectly with it than with any other material. A good impression may be obtained with plaster by first taking a wax or modelling-compound impression; then cutting away so as to have the impression very little larger than the plate is to be, and then using a small quantity of plaster the consistence of cream. For partial cases, I sometimes use the modelling compound, but with this substance care must be taken to prevent its warping. But no matter what material is used, we can never get two casts alike of the same mouth from different impressions taken at the same sitting. In many cases it is a very difficult operation to take a good impression.

Dr. Tees.—I must go upon the record as one who uses nothing but wax for taking impressions. I discarded plaster several years since, after using it for upwards of ten years. I found its use not only unpleasant to myself but to my patients. I think more credit is given to it than it deserves. By wax I mean pure yellow beeswax, such as is sold at the dental depots for the purpose, and which should be properly heated; and not the oily, dirty stuff that has been lying around the laboratory for months and been spoiled in over-heating. Students should be taught to take good impressions with all the materials in use, and not be restricted to plaster and forbidden to use anything else.

The regular meeting was held at the office of Dr. E. C. Kirk, 1602 Arch Street, Saturday evening, Nov. 3d, 1883. President Truman in the chair. The following paper was read upon the

RELATION OF FOOD TO THE TEETH.

BY E. C. KIRK, D.D.S.

So much of our time is devoted to the repair of carious teeth by the various mechanical methods of filling, that when we are fortunate or skilful enough to succeed in arresting decay by these means, we are too apt to feel that we have done all our patients have required of us, but should our attention cease at this point?

It is my purpose this evening to direct your thought to some points relating to the proper nutrition of the teeth, a disregard for which, in my belief, is one of the most fruitful predisposing causes of caries.

For the past eighteen months I have had under my care the mouths of between three and four hundred children, pupils of the Pennsylvania Institution for the Deaf and Dumb, and to the statistics furnished me by the superintendent, relating to food, clothing, hygienic conditions, &c., together with my personal examination and supervision of their mouths and teeth, I am largely indebted for what knowledge I have obtained relative to the positive effects of proper food on the teeth. It is only where a considerable number of individuals are provided with the same quality and amount of food, and all the other conditions of living are as nearly as possible equal, that we can hope to obtain reliable data from which to study such a subject successfully and intelligently. The teeth of these deaf mute children present many points of interest, and a close observation of them has served to fix in my mind the conviction that if we should successfully combat the ravages of dental caries our attentions must not cease after we have restored by filling the tissue which has been destroyed, but by instructing our patient, and especially the parent or guardian, in the case of children, as to the proper course of diet and mode of living to be pursued during the period of calcification of the bones and teeth, we can secure for them the kind of nourishment required and insure practically sound dental organs in many cases.

On examining the mouths of a class of children, recently admitted to the institution, the teeth present no peculiarities worthy of special notice, except in most cases a lack of cleanliness and an average amount of caries, not greater than we would expect to find in the mouths of the same number of children where no previous dental care had been given, and where brush and powder were unknown; the tooth structure is often quite soft and the decay is largely of the white variety, such as occurs in teeth deficient in mineral constituents. They come to the institution from the lower walks of life as a rule, their parents in many cases being poor and unable to provide them with proper food and care; as a natural result there are many whose dentures are riddled with caries, pulps exposed, and the teeth apparently melting away. In those whose deafness is acquired through disease, viz., scarlatina, measles, cerebro-spinal meningitis, the teeth frequently bear evidences of the high febrile conditions through which the patient has passed, by pits in the enamel, crimped edges, defective form, imperfect development or soft structure. The majority of the pupils are admitted between the ages of ten and twelve years. After a year's residence in the institution, during which time they are given excellent care in all that relates to their physical welfare, a marked improvement will be observed in the character of their teeth, they will be found exceedingly hard and dense, making the wear and tear

on cutting instruments very great; excavators and chisels have to be tempered to the point of brittleness to be effective in preparing cavities, otherwise they will not cut the extremely hard structure. They are firmly set in their sockets, making them unusually difficult to extract. These are not visionary observations, but the result of repeated tests and examinations carefully made. But the most conclusive evidence which I have met with of the value of their diet table, so far as the nutrition of their teeth is concerned, is the unusual number of cases of arrested caries and the formation of the so-called secondary dentine.

You are well aware that such action can only take place under the most favorable conditions. Nature never makes an attempt to repair a carious tooth unless she is compelled to by an excess of tooth and bone forming pabulum in the blood. I have seen from time to time cases in private practice where this action had taken place, but they occur rarely. Among the pupils of the Deaf and Dumb Institution it is quite common, not only in the permanent dentures but also in the temporary sets. As showing still further the abundance of bone-forming material with which their blood is supplied, I have removed in two cases large pulp nodules from the sixth year molars of children not over 11 years of age; these I considered unique, as I had never met with this formation before in patients so young.

When we consider the change that has taken place in the physical characteristics of these teeth, we naturally ask: What has produced such a marked improvement? The diet table approved March 1st, 1882, and which has been in use since that time, is as follows:

DIET TABLE, PENNSYLVANIA INSTITUTION FOR THE DEAF AND DUMB, APPROVED MARCH 1ST, 1882.

Sunday—breakfast: Milk, 1–2 pint; one egg, or hash; bread, 5 ounces; butter, 1–2 ounce. Dinner: Roast beef, 6 ounces; gravy; potatoes; beans or beets; bread, four ounees; stewed fruit, 4 ounces. Supper: Milk, 1–2 pint, bread, 5 ounces; butter, 1–2 ounce; ginger cakes.

Monday—breakfast: Milk, 1–2 pint; Indian mush, 5 ounces; bread, 5 ounces; butter 1–2 ounce. Dinner: Roast mutton, 6 ounces; gravy; potatoes; cabbage or tomatoes; bread, 4 ounces; bread pudding, four ounces. Supper: Milk, 1–2 pint; bread, 5 ounces; butter, 1–2 ounce; stewed fruit.

Tuesday—breakfast: Milk, 1–2 pint; oatmeal porridge, 5 ounces; bread, 5 ounces; butter, 1–2 ounce. Dinner: Rump steak, 6 ozs; gravy; potatoes; onions or beans; bread, 4 ounces; corn starch or

tapioca, 4 ounces. Supper: Milk, 1–2 pint; bread, 5 ozs.; butter, 1–2 ounce; molasses.

Wednesday—breakfast; Milk, 1–2 pint; grits, 5 ounces; bread, 5 ounces; butter, 1–2 ounce. Dinner: Soup, 3–4 pint; stewed beef, 6 ounces; gravy; potatoes; tomatoes; bread, 4 ounces. Supper: Milk, 1–2 pint; bread, 5 ounces; butter, 1–2 ounce; cottage cheese.

Thursday—breakfast: Milk, 1–2 pint; Indian mush, 5 ounces; bread, 5 ounces; butter, 1–2 ounce. Dinner: Roast mutton, 6 ozs.; gravy; potatoes; turnips or carrots; bread, 4 ounces; stewed fruit, 4 ounces. Supper: Milk, 1–2 pint; bread, 5 ounces; butter, 1–2 ounce; molasses.

Friday—breakfast: Milk, 1–2 pint; oatmeal porridge, 5 ounces; bread, 5 ounces; butter, 1–2 ounce. Dinner: Fish, 8 ounces; or corned beef, 6 ounces; potatoes; cabbage; bread, 4 ounces; rice pudding, 4 ounces. Supper: Milk, 1–2 pint; bread, 5 ounces; butter, 1–2 ounce; stewed fruit.

Saturday—breakfast: Milk, 1–2 pint; grits, 5 ounces; bread, 5 ounces; butter, 1–2 ounce. Dinner: Soup, 3–4 pint; roast beef, 6 ounces; gravy; potatoes; onions or beets; bread, 4 ozs. Supper: Milk, 1–2 pint; bread, 5 ounces; butter, 1–2 ounce; molasses.

Breakfast—Children over thirteen years of age may have coffee.

Dinner—Soup shall be made of dried beans or peas, or of fresh vegetables. Dinner may be occasionally varied by the substitution for beef or mutton of poultry on holidays, or of oyster soup in place of fish or corned beef. Vegetables may be varied according to season. Fresh fruit may be given for desert in place of stewed fruit.

Supper—Children over thirteen years of age may have tea.

When we consider that the institution is a charitable one we must admit that the food furnished is not only varied in kind but in liberal quantity. They are not cloyed with sweetmeats or pastry, and while the amount furnished is ample for the demands of health, there is no danger of over-feeding and consequent indigestion. The amount of sugar given, including molasses, does not exceed a quantity beneficial to health.

The question might perhaps arise, "does not this bill of fare become monotonous, and is there sufficient variety to insure a hearty relish which is so essential to the proper digestion and assimilation of food?" The fact is, the children always come to the table with good appetites, and are firm believers in the course pursued by Jack Sprat and his wife, who, as history tells us, "cleared the cloth and licked the platter clean." There is an abundance of bone-producing material given, and a proper balance maintained between the starchy and saccharine on the one hand, and the fatty and nitrogenous constituents on the other.

Oatmeal and wheat grits have been recommended, and justly so as a proper food for hardening the teeth, on account of the abundance of phosphatic material which exists in the outer covering of the grain; still, damage can be done in the improper use of these. I was afforded an opportunity by Dr. Eisenbrey to examine the mouth of a patient of his, a boy of perhaps fifteen years of age, whose teeth looked as though he had lived principally on candy; they were soft and sensitive with an eroded appearance of the enamel, which, though perfectly white and clean, was rough and softened as though it had been dipped in a strong acid. The young man was excessively fat. Upon making inquiry of his father, who was present, as to his son's usual diet, at the same time calling his attention to the eroded condition of his teeth, he said he was sure his food could have nothing to do with it, for he was very fond of oatmeal, and that was always highly recommended as beneficial to the teeth." Upon asking him if he used much sugar with it, he said: "Oh yes! in large quantities—he fairly covers it up in sugar." Here, then, was the secret: the mass of oatmeal was sweetened to an extent almost nauseating, and its nutritive qualities were more than balanced by the fat and heat-producing properties of the sugar. His pampered and petted existence, together with a lack of sufficient exercise, had brought about a condition of obesity amounting to disease, and wholly incompatible with a healthy denture. Nutrition comprehends digestion, absorption, respiration, circulation and assimilation; upon the harmonious action of these separate functions depend life, growth and health. While the object of my paper has been simply to show the effect that a fixed and uniform diet has had upon the teeth of a given number of children, I would not ignore the importance of proper hygienic measures and methods of living, without an observance of which, proper digestion, absorption and assimilation are impossible. Nor would I be understood as asserting that the diet list which I have quoted is the only proper one to follow. I have brought it to your notice because I believe it to be an important but by no means the only factor in producing good, strong and dense teeth at the Deaf and Dumb Institution. It does present some features which, taken in connection with the results achieved, form a basis for some important deductions. The food is plain, well-cooked and wholesome, there is a total absence of sweetmeats and pastry, the amount of animal food bears but a small proportion to the vegetable, a liberal amount of whole grain, *i. e.*, that which has not had the outer or phosphatic envelope removed, is supplied in the shape of oat and wheat grits, there is a total absence of fried and greasy food, and last a liberal supply of milk. All this, with a good appetite and thorough digestion and assimilation,

goes far toward accounting for the unmistakable improvement which certainly takes place in the quality of their teeth. Much could be said and ought to be said upon the evils of badly-ventilated school-rooms and sleeping apartments, late hours and the constant overstimulation of the brain by an endless variety of exciting causes, or, what is equally bad, the high-pressure system of education so much in vogue at the present time, by which children are loaded down with an amount of mental work which the majority of them are physically incapable of carrying; this too, at a time when their most rapid growth is taking place, diverting from its proper function the nerve force which should have been applied to physical development. The results of this state of affairs we see around us daily, a finely-developed intellect, a highly-cultivated and educated brain united to a body, the principal object of which seemed to be to make life a burden.

The data which I have presented to you, and the observations upon them have occupied my thought and interested me for some time. I bring them to you hoping they may throw some light upon and in some degree add to our knowledge of the causes of dental caries, and especially its preventive treatment.

Discussion.

Dr. Darby.—I have been greatly interested in Dr. Kirk's paper, because the condition of the teeth of the children spoken of corresponds so perfectly with my own observations in a similar institution.

Some years ago I had charge of the teeth of the children in Burd Asylum, and I was astonished to find the general condition of them so good. It was rarely that caries was present upon the approximal surfaces of the teeth.

The children had the best of care, were frequently bathed, and the diet, while simple, was of the most nourishing character. The gentleman who had personal charge of the institution felt the importance of careful cleansing of the teeth, and he insisted upon each child brushing the teeth daily with powder. He provided good brushes and plenty of powder, and I have never seen a lot of children, ranging in age from eight to eighteen, whose mouths were cleaner.

I doubt not, the simple food upon which they were fed, and the abundance of exercise which they took in the open air, had much to do with the good quality of their teeth. I do not think, however, that the character of tooth structure can always be changed by the character of the food. It would take more than one generation to insure a perfect dental system.

We cannot urge too strongly the importance of a diet which contains the phosphates in abundance.

We can tell what would have been the condition of the teeth of the children under Dr. Kirk's care had they not lived upon food so well calculated to make good teeth.

I am reminded of an anecdote related of Prof. Agassiz. He was a good advocate of fish food for the brain. Some friend of his chanced to find on the New England coast an idiotic boy who had been raised along the coast, and whose fare had been largely fish. His head and brain were unusually small even for an idiot. Calling the Professor's attention to the boy they said, "Here is an illustration of your theory of brain development from fish food." The great naturalist looked at the boy a moment, and then, turning to his companions, said, "What would he have been had he not lived upon fish?"

Dr. Chupein.—While I was practicing at the South, a young lady presented herself for attention to her teeth. I noticed that the four sixth-year molars had been all decayed, but the decay had been arrested by some process of nature. It presented the usual blackish-brown color, and was highly polished. This being so unusual a case I questioned the lady, and elicited the following history: Miss P. was the daughter of an extensive planter; up to her seventh or eighth year she lived on the plantation a humored and spoiled child. Her parents lived in sumptuous style, their table being supplied with every delicacy, and she had scarcely to lift her hand, having servants to attend her, and her every wish supplied. But at the age above-mentioned she was sent to boarding school. Here quite a change in her life ensued. Hard fare and plenty of exercise took the place of table luxuries and inactivity. To this change in her life I attributed the arrest of decay in the teeth alluded to, while those that were afterwards encysted remained free from decay until a return to the luxurious style of living, after her education had been completed, brought on again the penalty of decay.

I am intimately acquainted with a lady whose children were remarkable for the poor character of their teeth. I advised her to take lime water with her tea, coffee or milk during her time of utero-gestation. She took my advice, and the child that was born after this regimen had splendid teeth, which remained good up to its sixth year.

Dr. Darby.—Do you think that lime gets into the teeth in that way?

Dr. Chupein.—Yes; I believe that the lime is distributed throughout the system, and will be properly appropriated. It is true that all the excretions abound in mineral elements, yet nature appreciates a bountiful table better than a poor one.

Dr. Jack.—What other hygienic treatment do the children receive?

Dr. E. C. Kirk.—The order of the day is about as follows: The children rise at 6 o'clock, and consume half an hour in preparing for breakfast, which takes place from 6.30 until 7 o'clock. At 8.30 religious exercises are held in the chapel, and at 9 o'clock they go to school and remain until 11.30. At 12 they partake of dinner, and at 1 return to school, and remain until 3.30, after which the smaller children are free to play till supper time—6 P. M. At 8.30 they retire. The larger boys, after school hours in the afternoon, work in the shops till 5.30, where they are taught tailoring, shoemaking, &c., and the larger girls are given instructions in practical cookery, plain sewing, &c. These more advanced pupils have one hour for study in the evening, from 8.30 to 9.30, and retire at 10 o'clock. Out-door exercises and sports are freely indulged in and encouraged, both in winter and in summer, and personal cleanliness is enforced upon all of them.

That a marked improvement does take place in the quality of their teeth, after they have remained in the institution a year, is perfectly evident. Calcification of the permanent teeth takes place after birth; they do not reach their full degree of density until some time, often years, after their eruption. That teeth, through mal-nutrition or cachexia, often become soft and easily broken down is well established. It is perfectly reasonable, therefore, that a progressive reparative action should take place in such softened teeth where all the conditions for their nutrition, and a maintenance of that balance of the bodily functions which we call health, is observed.

Dr. Jack.—The abundance of free exercise in the open air is of the utmost importance to secure the proper assimilation of nutritive material, and to establish a correct balance of physiological functions. The general patient suffers, not so much from insufficient or irregular diet, as from habits of life which do not stimulate correct alimentation. [Dr. Jack enforced this position from cases common to all, and also by special cases occurring in his experience.]

Dr. Jas. Truman.—It seems to me quite possible for observations of this character to be fallacious, though I am very glad at last we have a prospect of having positive data upon which to base at least an opinion.

During the twelve years in which I was connected with the institution of the blind of this city there was no peculiar diet arranged for the children. The food was simple but ample. The condition of the teeth was very similar to that described by Dr. Kirk. I attributed this then and now more to the regularity of life and constant exercise

in the open air than to any peculiar form of food; but at the same time am not prepared to deny that the improvement noticed by Dr. Kirk may not have taken place in the remarkably short time stated by him.

The question of diet, in its relation to tooth structure, is one not by any means understood. While it is very true that certain foods contain more of the elements required for nutrition of tooth substance than others, it still remains equally true that all nations, on all varieties of food, have, as a rule, equally good teeth. The exceptions can be explained upon temporary local influences.

Admitting that Dr. Kirk's position is the correct one, and that nodules of secondary dentine have been formed in a year's time by the diet described, does it not follow that there is a possibility of destroying the teeth by too great density? Notwithstanding that Wedl and others undertake to deny the possibility of consolidation of the tubules, it is, nevertheless, a demonstrable fact that a tooth may become so dense that nutrition ceases, and it becomes virtually a foreign body, to be thrown out of the mouth by natural processes. Examinations, microscopically, of such teeth have demonstrated that the tubes may be completely obliterated. If such be the case, is there not a possibility of going too far in our efforts to prevent the attacks of caries?

The regular meeting was held Saturday evening, December 1st, 1883, at the office of Dr. Chupein, 1408 Pine St. President James Truman in the chair. The following paper was read upon

OPERATOR AND MECHANIC.

BY F. R. FABER, D. D. S.

Having for a long time been desirous of learning in what manner the operator regards his mechanic, and to hear the opinions of such an experienced body of men as I have assembled before me to-night, I have selected this subject for your consideration. I did not come here to-night to rehearse the wrongs of the mechanic, or to pour forth my soul in bitterness, but to present you with a few thoughts which I know will be fairly considered and impartially discussed.

That the mechanical dentist is a necessity no one will deny. That the professional mechanic is also an absolute necessity is perfectly clear to you, who are before me, representing as you do the best class of practice—a class of patients who seek the best operators, and who are able and willing to pay for all operations.

The cry that was raised a few years ago about the inevitable decline in mechanical dentistry has died out, notwithstanding the exhaustive papers and discussions that followed it. In fact I think in place of a decline it has increased and multiplied.

The dentistry required by families cannot be secured and retained without the exercise of this branch of the art. A mechanic therefore becomes a necessity. One to be relied on, who will be particular in every detail and extremely neat. Men of this kind can be found, and plenty more will develop if the proper support is shown them by operators.

The operator expects a plate that will fit, with teeth that will occlude properly, that it be finished on time, that the mechanic will look after the work, send for it, deliver it when finished, shade the teeth absolutely, be responsible for all breakage, and if it should not be a success make it over for practice. This is expected of the man who does the maximum share of the work for the minimum share of the profits.

Now, what does the mechanic expect? A good impression, a correct bite, with the marks of the opposing teeth deep enough to distinguish without the aid of a microscope, a reasonable time in which to complete the work, a fair price for his labor, computed from a professional standpoint, and remuneration when the fixture is completed. This is a very important point with the mechanic. I have never heard of one growing rich and doubt if any one else has.

And lastly he expects the support of the operator, which is absolutely necessary to the making and keeping of good mechanics. Not only the partial but the full support in the dull season.

The operator makes in his own little laboratory the cases which come into his hands, taking this profit from the mechanic at the time when it is most needed, and denying himself the rest he should have after a hard season's work.

The maintaining of a laboratory is an expensive procedure. Assistants cost money—experienced ones must be secured in order that the patrons of the establishment do not become dissatisfied. The mechanic is expected to have all the improved apparatus, to be familiar with its working and to be able to converse intelligently upon its merits.

The subject has now been opened and is ready for your consideration. As I said before, I present it to you as much for my own information as I do to advance the interests of the dental mechanic, and to help him along to the place he will soon occupy—a specialist in his branch, recognized as such by the operator, and patronized by the public in the same capacity.

Discussion.

Dr. Guilford.—I am exceedingly pleased with the paper, because it brings out the importance and position of the mechanical dentist in a true light. He prefers to work for those who know something practically of the work they undertake, who know what they want and how to do it, but have not the time; I have always held that each student of dentistry should have as thorough a training in the prosthetic as in the operative branch; and that he should practice both until the operative occupies all his time, when he should employ a competent mechanical dentist to do the plate work for him. Unless he does his own mechanical work for a number of years he will not gain the experience in the taking of impressions and articulations, the selection of teeth and the fitting in of the finished piece; that he needs to enable the mechanical dentist to do his part for him intelligently and satisfactorily.

The mechanical dentist should not be annoyed by working for those who cannot give him accurate impressions and true bites, and who lack the ingenuity and skill necessary to the fitting of a complete set. If skilled he will by constant practice be able to do better work for us than we can do ourselves. Besides, he gives us the maximum of work for the minimum of price and should be encouraged in his best efforts by practitioners who have not the time to do their own work. Anyone who spends his day at the chair does himself great injustice by spending his evenings in the laboratory. He is burning the candle at both ends, and will suffer for it sooner or later. I made that mistake through many years and greatly regret it now. This mistake, however, is fully equalled by the young practitioner who gives out his work when he should be doing it himself, and thus be helping to meet his weekly boarding bill. No dentist should be without a properly equipped loboratory, but he should use it in a way that will be a benefit to him and not an injury.

Dr. Register.—I think the general application of Dr. Faber's paper will settle itself. In large cities the mechanical dentist is an absolute necessity; men in large practice would have to give up artificial work if it were not for these specialists. The relation of the one to the other depends upon circumstances. I should judge it to be the same as the optician to the oculist or the surgical instrument maker to the surgeon, good instructions from one to the other being necessary to secure good results. If dentistry is a profession requiring the skill of the surgeon and the care of the physician the time is propitious for the dentist to assert himself as such. The care given the teeth is increasing with each generation, and to-day mothers bring

their children, being aware of the criminality of neglect at an early age.

Dr. Darby.—It is of the utmost importance that the mechanical dentist be furnished a perfect impression if satisfactory results are expected.

Not infrequently they are given an imperfect impression and then blamed if the fit is not good.

Dr. Chupein.—How can we know when we have a perfect impression? I have taken impressions wherein every rugæ, every line, every depression were faithfully reproduced in the negative, and yet a model made from such an impression failed to afford the plate I made on it anything like a proper adhesion. I scrape the impression where the mouth is hard and scrape the model where the mouth is soft, but yet I fail in very many cases, and after the most careful manipulations, to obtain such an adhesion of the plate as to enable my patients to chew on their artificial teeth without dislodging them.

Dr. Tees.—In many cases it is impossible to get an atmospheric pressure, even with the most perfect impression. It is necessary to manipulate plates in various ways.

Dr. J. B. Wood.—An operative dentist in passing a case to a mechanical dentist cannot be too particular about his impression, as without a good one no amount of skilled work will make a satisfactory case, but where a good cast of the mouth is obtained a slight spring in the plate or other slight irregularity will not interfere seriously with a good result. I have had experience of this kind.

Dr. Jefferis.—It seems to me that if the impresssion is good and the set a failure the fault would be with the mechanical dentist. If a bad impression, then it would be the fault of the operator. But misfortune follows us all at times. It is an easy matter for Philadelphia dentists to have good mechanical assistance. But having none in Wilmington we are compelled to send it back and forth by express or do it ourselves. To get good adaptation I scrape away each side of palatine ridge, and the palatine aspect of the alveolar ridge just where the edge of the plate is intended to be, so that it shall fit more closely there than elsewhere. All plates will draw together somewhat at the heels; this counteracts any want of adaptation by such drawing.

Dr. Register.—Many plates require manipulating on account of the resistence being irregular, and for this reason I think the modelling preparations give us excellent results. In cases difficult of adaptation a trial plate of pure silver may save much trouble and vexation.

Dr. Chupein.—When taking the bite or articulation I do not rely only on the impression left in the wax on the upper base plate. I take a separate impression of the lower teeth and from it make a

model, and when the impression is left by the lower on the articulating wax of the upper base plate, I place this model into the impression left in the articulating wax. In this way I have exact counterparts of each jaw to place in the articulator and can work more intelligently. Allusions have been made to having both the teeth and the gums perfect, that a wax impression leaves the teeth as thick at the gums as at the cutting edges, but that a *fac-simile* of both teeth and gums is obtained by a plaster impression. I think that as the gum is the tissue we have to work on, a faithful representation of the teeth is of secondary importance. In vulcanite work the vulcanite has to be filed away to let the plate pass over the largest part of the teeth, irrespective of the construction at the neck; while in metal work a similar cutting has to be made to admit of the placement and removal of the plate.

INCIDENTS OF PRACTICE.

DR. REGISTER.—I have made an improvement upon the artificial crown I described to you two years ago. It is useful also for bridge work.

FIG. 1.

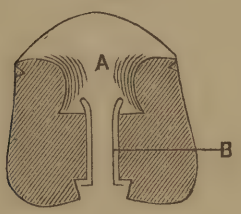


FIG. 2.

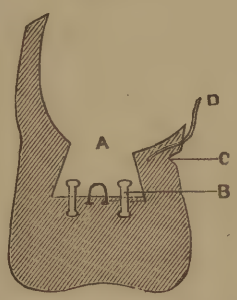


Fig. 1. is a plain tooth, vertical section, with a channel across the neck portion, A, from approximating points, as found in a natural tooth, by separating the crown from the root. Fig. 2, gum attached, transverse section, from the face of the neck into the crown part, a dove-tail is carved out to any desirable length, and a continuation of the core made cylindrical, in which is burned a platina tube, B. The lower end after shrinkage of the tooth is converted into a matrix, and the upper slightly enlarged by pressing into it a tapering instrument. This is the tooth I use for crowning devitalized roots, and for bridge work. The other, which may be made single or in sections of any predetermined shape, does away with the tube and in its stead are fused in at the bottom of the dove-tail, one or more pins or wires or staples, Fig. 2 B, as the class of work may call for; at the neck is a V or U-shaped groove, Fig. 2 C, extending around the neck of plain tooth and palatine portion of gum tooth into which a grip is made outside the tooth by either celluloid or vulcanite; and just above the groove, Fig. 2, is a wire pin, D, extending into the substance of the

plate. In continuous gum work, the dove-tail is done away with, and the platina tube allowed to pass from crown to neck, and soldered into plate from centre by a pin and inside pin. These teeth are copies from nature, and the method of anchorage to natural roots left entirely to the individual operator, there being scarcely any limit to them. The most prominent ones are by a threaded post adapted to the How crown fixtures, and cemented to place by alloy, gutta-percha or phosphate of zinc. Another method is to adapt the root, crown and post together, attaching the two latter together temporarily by pressing a piece of wax at the grinding surface into the opening, withdrawing them, investing them in plaster and asbestos and soldering, then securing it to the root by gutta-percha or phosphate of zinc. When the former is used, the tooth and pin can be warmed up to a proper temperature, and every part thoroughly filled and pressed to place. These are the only teeth, so far as I am aware, that present a perfectly natural appearance at all surfaces. In every class, they maintain this natural appearance; and in all kinds of artificial work do away with the disagreeable necessity of banking up the plate on the palatine surface. My experience in the use of these teeth has simply filled me with pleasure and admiration for their strength and beauty.

Dr. James Truman.—I desire to relate an incident in practice, that occurred during the day, illustrating one of the many unpleasant difficulties that beset the practitioner. A lady past middle life called to have an inferior bicuspid treated. The case was taken in hand, and as the mouth was dry and amalgam to be used, the dam was not resorted to. While carefully filling the frail remnant, the lady suddenly threw up her hands and with a bound sprang from the chair and the next minute was mounted on the sofa wringing her hands, her face indicating all the intense agony of suffocation. As this was clearly apparent, and knowing not a second of time could be lost, I seized her and by a powerful effort succeeded in depressing the tongue and drawing it slightly forward. This gave immediate relief, and the patient regained her power of breathing. The supposition was that a foreign body in some unexplained manner had passed into and obstructed the air passages, but this was soon found to be an error, and that the attack originated in muscular contraction.

The explanation given by her was, that these spasms had been quite frequent, usually occurring at night, but this was one of the severest she had ever had. This aggravation was doubtless caused by the naturally increased nervousness of her position as a patient. This very dangerous complaint is fortunately rare in this form of presentation, though spasm of the larynx and spasm of the glottis accompany many laryngeal diseases.

DR. REGISTER.—I operate for a gentleman predisposed to heart trouble, with whom I have to be exceedingly particular. Throwing his head back will sometimes bring on spasm of the glottis, and I have to pull his tongue out very quickly or he would suffocate.

IN MEMORIAM.

MARSHALL H. WEBB, D. D. S.

At the regular meeting, held January 6th, 1883, the following was adopted as a tribute to the memory of our late fellow member:

"We desire to express, as far as words can, our deep sorrow for the death of MARSHALL H. WEBB, D. D. S., and our recognition that with him we have lost not only a most worthy member but a sympathizing friend. With deep regret we realize that we shall never again listen to his gentle voice nor feel the force of his personal magnetism.

"Death never enters into any family, a group of friends, or an association of any kind, but it trails a shadow to darken some life, to sadden some heart and render obscure the pathway of the future.

"In the death of our colleague and friend we recognize the full force of this, for he not only leaves a sorrowing family but his departure involves a large circle which has felt his influence, and will continue to feel it far into the future.

"Dr. Webb was no ordinary man. He was essentially a leader, not in the sense of arrogant assumption; but as one who took his place through earnest toil, unselfish devotion and conscientious ambition. He labored that others might grow. He mined that the professional fires might burn all the more brilliantly, and though his day was short, every hour was full, and the record thereof may be filed away in the hearts of his friends with the indorsement, 'Well done, good and faithful servant.'

"The hour of death is not the hour for critical judgment. Dr. Webb's work belongs to his profession. The ideal that he labored for was his ever constant inspiration. To accomplish it no sacrifice was too great, no labor too exhausting. No life can be valueless that aims at excellence; but how much more worthy

of emulation is the harvest when gathered with the golden grain ripened to perfection? In his special work our friend reached an acme of skill beyond which he had no superiors. Perhaps he may not have always worked wisely; it may be that his unswerving devotion to his ideal brought him to suffering and death; but if so, he leaves a monument in his example that will be an honor to his name and a glory to his profession.

"We wait, watch and linger by our dead. Their memory hallows our lives, their deeds are graven on sorrowing hearts; but as we linger, the funereal knell reminds us again that change is the law of the universe and that, in the translation of another we inherit the work of a life, which should be an ever present incentive abiding with us forever.

"*Resolved:* That a copy of the foregoing be transmitted to the family of the deceased with the assurances of our deep sympathy with them in their affliction, and also forwarded to the dental journals for publication."

IN MEMORIAM.

THOMAS L. BUCKINGHAM, M. D., D. D. S.

At a memorial meeting held October 30th, 1883, under the auspices of the Dental Societies of Philadelphia, the following resolutions were adopted as a tribute to the memory of our late fellow member:

WHEREAS, It has pleased Almighty God in His great omniscience to call from our midst our friend and brother THOMAS L. BUCKINGHAM, and

WHEREAS, By his removal the students under his charge and the dental profession have sustained a severe loss, all of whom acknowledge the privation to which they are subjected, both in professional and social intercourse with him; and

WHEREAS, The members of the Pennsylvania Association of Dental Surgeons, The Odontographic, and the Odontological Societies of Philadelphia, having spontaneously met together to pay a tribute of respect to his memory, and to place on record the deep feeling of sorrow which his death has occasioned, as well as to express their humble submission to the fiat of the Most High, which admits of no recall, Therefore be it

Resolved, That in the death of Prof. Buckingham, the dental

profession loses one of its earnest and faithful workers,—one who for many years has devoted his time, talent, and means to advance its general interests. His labors in the laboratory—beginning almost with his first entrance into the profession and ending only with his death—endeavoring to solve the various questions that have from time to time occupied professional thought; his many carefully conducted series of experiments which have enabled us to work with more ease, certainty, and intelligence, and his numerous contributions to Dental Literature, are a legacy to the profession we accept with grateful appreciation.

Resolved, That his long service as a dental instructor, beginning with the first Dental Faculty organized in Philadelphia, and continuing without interruption for thirty-two years, is a recognition of his ability as a teacher that we emphatically endorse.

Resolved, That his liberal and tolerant spirit, his cordial greeting, and his genial disposition, endeared him alike to the students whom he taught and to all with whom he mingled.

Resolved, That the city of Philadelphia has lost a valuable and upright citizen, and each one of us an acquaintance and friend whom the more we knew of him, and the riper the intimacy, the more we recognized his sterling worth, his kindly disposition, his social qualifications, and all those endearing attributes which go to make up a good, true, and noble man.

Resolved, That to the young in our profession his loss will be especially severe, as his fund of knowledge and mature judgment, together with a willingness to impart information, encouraged the humblest and the most timid to seek his counsel. That gaining information by his own hard labor, he felt it a pleasure to aid others in its acquisition; and in doing this made the recipient feel as if he conferred rather than received the benefit.

Resolved, That we, fellow practitioners, together with the Faculty and Students connected with the Pennsylvania College of Dental Surgery, mourn his loss with regret no words can express.

Resolved, That we tender to his family our heartfelt sympathy, and that a copy of these resolutions be forwarded to them as a token of our condolence.

Members of the
ODONTOLOGICAL SOCIETY OF PENNSYLVANIA.

1883-84.

Charles J. Essig,	Edwin T. Darby,
H. C. Register,	Daniel Neall,
Ambler Tees,	J. A. Woodward,
H. C. Longnecker,	W. G. A. Bonwill,
S. H. Guilford,	C. A. Kingsbury,
E. H. Neall,	H. K. Leech,
Robert Huey,	M. L. Long,
F. M. Dixon,	R. R. Underwood,
Louis Jack,	J. L. Baker,
E. R. Pettit,	D. N. McQuillen,
Joseph Pettit,	J. B. Wood,
James Truman,	S. B. Luckie,
Theo. F. Chupein,	C. R. Jefferis,
Geo. A. Maxfield,	C. E. Graves,
E. C. Kirk,	C. F. Bonsall,
S. E. Gilbert,	J. C. Townsend,
J. D. Thomas,	J. R. Yorks,
T. W. Buckingham,	James Martin,
H. M. Sheppard,	Wm. Diehl,
F. R. Faber,	Wm. L. Cave,
Joseph M. Noble,	Geo. Roberts,
J. A. Hartman,	J. S. Gilliams,

F. F. Robinson.

Deceased Members.

Marshall H. Webb, died January 1st, 1883, in the 39th year of his age.

Thomas L. Buckingham, died September 4th, 1883, in the 68th year of his age.

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